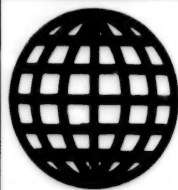


JPRS-EST-94-010
7 June 1994



**FOREIGN
BROADCAST
INFORMATION
SERVICE**

JPRS Report

Science & Technology

Europe/Internáional

Science & Technology

Europe/International

JPRS-EST-94-010

CONTENTS

7 June 1994

WEST EUROPE

ADVANCED MATERIALS

Germany: Fluorine Gas Promising for Analysis of High-Performance Materials [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 15 Mar 94] ...	1
German Institute Develops Coating for High Temperature Turbine Blades [Stuttgart BILD DER WISSENSCHAFT, Apr 94]	1
Germany: Diamond Films Produced From Coconuts [Berlin INGENIEUR DIGEST, Mar 94]	2
Germany: BMFT Supports Diamond Film, Cubic Boron Nitride Project [F. Miller; Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 2 May 94]	3
Germany: New Method Used to Develop Heavy-Duty Components Without Lubricants [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 2 May 94]	4
French Firm Develops Aluminum/Ceramic Composite [E. Jullien; Paris INDUSTRIES ET TECHNIQUES, Mar 94]	5
France: Researchers Make Material Breakthrough [Paris SCIENCES ET AVENIR, Apr 94]	5
Swedish Navy Tests New Ultra-Light Stronger-Than-Steel Shafts [Toddington NEW MATERIALS INTERNATIONAL, Apr 94]	8

AEROSPACE

France: Ariane 5 MPS Motor Body Passes Structural Test [Paris LA LETTRE DU GIFAS, 10 Mar 94]	9
France: Airbus to Study Very Large Aircraft Project Independently [Paris LE MONDE, 10 May 94]	9
France: Airbus Adapts A300, A310 for Military Transport [Paris AFP SCIENCES, 3 Feb 94]	9
France: Aerospatiale Reports Smaller 1993 Losses [Paris AFP SCIENCES, 17 Mar 94]	10
Aerospatiale, BAe, DASA To Cooperate on Concorde Successor [Paris AFP SCIENCES, 14 Apr 94]	10
France: CNES 1994 Budget Announced [Paris AFP SCIENCES, 17 Mar 94]	11
France: Matra Marconi Space To Build New EUTELSAT [Paris AFP SCIENCES, 31 Mar 94]	13
ESA Manned Space Flight Program Adjustments [Paris AFP SCIENCES, 31 Mar 94]	13
Germany: Instruments for Atmospheric Research Missions Readied [Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN, 25 Mar 94]	13
Germany: More Precise Measurement Possible With PRARE System [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 10 Mar 94] ...	14
Austria Becomes EUMETSAT Member [AFP SCIENCES, 24 Mar 94]	14
Finland Becomes ESA Member State [Paris AFP SCIENCES, 24 Mar 94]	15
European Space Research	15
Decline of Columbus Program [O. Goering; Berlin INGENIEUR DIGEST, May 94]	15
German Participation in SSTO Vehicle [Berlin INGENIEUR DIGEST, May 94]	16
France, Israel Space Agencies Sign Accord [Paris AFP SCIENCES, 14 Apr 94]	16
Germany, Netherlands Cooperate on ENVISAT Instrument [Duesseldorf HANDELSBLATT, 30 Mar 94]	17
Germany-Japan-Russia: Spaceflight Cooperation [Berlin INGENIEUR DIGEST, May 94]	17
ESA To Test Satellite Data Transmission By Laser [R. Raaijmakers; Amsterdam POLYTECHNISCH WEEKBLAD, 18 Feb 94]	17
Netherlands, Germany Cooperate To Construct 'Sciamachy' [J. Piepe; Zoetermeer WETENSCHAPSBELEID, 1 Mar 94]	18

AUTOMOTIVE INDUSTRY

Germany: Rapeseed Oil Used To Propel Taxis in Freiburg [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 15 Mar 94] ...	19
Germany: Daimler-Benz Experiments With Hydrogen-Fueled Hybrid Car [Paris AFP SCIENCES, 21 Apr 94]	19
Automated Charging Station to Boost Electric Vehicles [R. Helmueller; Duesseldorf VDI NACHRICHTEN, 8 Apr 94]	20
Germany: Electric Auto Tests on Ruegen Continue [M. Lanzrath; Frankfurt/Main FRANKFURTER ALLGEMEINE, 3 May 94]	20
Germany: Daimler-Benz Prototype Electric Car Runs on Fuel Cell [Duesseldorf HANDELSBLATT, 14 Apr 94]	21

BIOTECHNOLOGY

Germany: Genetic Engineering R&D Funds To Be Increased [Duesseldorf HANDELSBLATT, 13 Apr 94]	22
Germany: Biological Remediation of Military Areas [N. Siegmund-Schultze; Munich SUEDEUTSCHE ZEITUNG, 10 Mar 94]	23
France: Human Genes Implanted in Animals [Paris AFP SCIENCES, 3 Feb 94]	24

COMPUTERS

Germany: JESSI Enhances Development of New Chip Processes [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 10 Mar 94] ...	24
France: CNES Develops Baghera Information Sharing Tool [Paris L'USINE NOUVELLE, 31 Mar 94]	25

DEFENSE R&D

Germany: Industry Requests Additional Funds for Eurofighter [Paris AFP SCIENCES, 14 Apr 94]	25
France: Government Seeks NH90 Helicopter Program Downsizing [Paris AFP SCIENCES, 14 Apr 94]	26
France: Charles-de-Gaulle Aircraft Carrier to Track 1,000 Potential Threats at Once [Paris AFP SCIENCES, 14 Apr 94]	26
France: 1995-2000 Defense Expenditures Proposed [J. Jacquier; Paris L'USINE NOUVELLE, 7 Apr 94]	27
France: Triumphant SSBN Launched [Paris AFP SCIENCES, 31 Mar 94]	28
France: 'Le Triumphant' SSBN to Begin Sea Testing [J. Isnard; Paris LE MONDE, 23 Apr 94]	28
France: Defense Minister's Announcement on Helios II Program [Paris LE MONDE, 30 Apr 94]	29
Aerospatiale Warning to U.K. Government on FTA Program's Fate [Paris LE MONDE, 11 May 94]	29
Italy: Aeronautical Research Center's Activities Outlined [M. Tavasani; Milan ITALIA OGGI, 11 Mar 94]	30
Italian State Group Buys Into Anti-Missile Control Venture [Paris LA LETTRE DU GEFAS, 10 Mar 94]	31
Eurofighter-2000 Maiden Flight Reported [Paris LE MONDE, 29 Mar 94]	31
France: Defense Minister Declares NH-90 Helicopter Essential [Paris LE MONDE, 25 Mar 94] ...	31

ENERGY, ENVIRONMENT

Germany: BASF Inaugurates Plastics Recycling Factory [M. Wendel; Bonn DIE WELT, 26 Apr 94]	32
Germany: Heavy Metals Immobilized, Hydrocarbons Degraded [Wuerzburg UMWELT MAGAZIN, Mar 94]	32
Germany: Recycling Lead Batteries in Freiburg [H. Stanschus; Berlin INGENIEUR DIGEST, Mar 94]	33

Germany: Recycling, Waste Management [R. Althaus; Berlin <i>INGENIEUR DIGEST</i> , May 94]	34
German Process Decontaminates Swedish Reactor Vessel [Bonn <i>TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN</i> , 25 Mar 94]	35
Germany-Saudi Arabia: Joint Research Project to Produce Hydrogen From Solar Energy Reported [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 9 May 94]	36
France: Strasbourg & Lyons Laboratories Develop 'Cage Molecules' [J. Meyer; Paris <i>L'USINE NOUVELLE</i> , 17 Mar 94]	36
Italy: Vegetable Diesel Oil Used For Vehicles, Heating Systems [E. Cagnazzi; Milan <i>ITALIA OGGI</i> , 8 Mar 94]	37
Netherlands: Largest Solar Energy Project To Start in Amsterdam in 1995 [Amsterdam <i>POLYTECHNISCH WEEKBLAD</i> , 14 Jan 94]	37
Elf Petroleum Creates Marine Pollution Research Center in Norway [J. Meyer; Paris <i>L'USINE NOUVELLE</i> , 24 Mar 94]	38
EU Sponsors Research In Fuel Cell Reformer Components [Zellik <i>TECHNIVISIE</i> , Apr 94]	39

FACTORY AUTOMATION, ROBOTICS

German Developments in Microengineering Outlined [Duesseldorf <i>VDI NACHRICHTEN</i> , No 14, 8 Apr 94]	39
German Market in Automation Technology Viewed [Duesseldorf <i>HANDELSBLATT</i> , 13 Apr 94] ..	41
Expert on Strategy of German Machine Tool Industry [HANDELSBLATT, 27 Apr 94]	42
German Research Produces User-Friendly Machine Tools [B. Bönzel; Duesseldorf <i>WIRTSCHAFTSWOCHE</i> , 29 Apr 94]	43
Germany: Developments in Laser Machine Tools Noted [A. Gerlach; Duesseldorf <i>WIRTSCHAFTSWOCHE</i> , 29 Apr 94]	44
Germany: New Series of Heavy-Duty Robots To Be Demonstrated [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 12 Apr 94]	45
Sale, Use of Industrial Robots in France Viewed [M. Scherer; Paris <i>INDUSTRIES ET TECHNIQUES</i> , Mar 94]	45
France: Snecma Automates, Integrates Design, Manufacturing Process [L. Girard; Paris <i>INDUSTRIES ET TECHNIQUES</i> , 2 Apr 94]	45
France: Sextant Avionique To Use Just-in-Time Method in 1994 [S. Farni; Paris <i>L'USINE NOUVELLE</i> , 28 Apr 94]	46

LASERS, SENSORS, OPTICS

UK: Luminous Silicon Developed for Optical Electronics [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 18 Mar 94] ...	47
UK: Liquid Crystal Displays With Manganese Improve Properties [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 10 May 94] ..	48
Germany: Carl Zeiss Jena Develops Optical Communication Terminal [G. Ludvik; Berlin <i>INGENIEUR DIGEST</i> , Mar 94]	48
Germany: 270 Million Marks Earmarked for Laser Research [Berlin <i>INGENIEUR DIGEST</i> , Mar 94]	49
France: REOSC To Market CEA's Optical Thin Film [Paris <i>AFP SCIENCES</i> , 3 Feb 94]	49
France: Synthetic Diamond Films Improve Lasers [M. Vilnat; Paris <i>L'USINE NOUVELLE</i> , 3 Mar 94]	50
France: LETI, PSA, Sextant Avionique Develop Optical Gyrometer [O. Esposito; Paris <i>L'USINE NOUVELLE</i> , 31 Mar 94]	50

MICROELECTRONICS

UK: Cost-Competitive Optoelectronic Silicon Chips Developed [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 2 May 94]	51
Netherlands: Five-Year Prorisc Chip Program Funded [Amsterdam <i>COMPUTABLE</i> , 4 Mar 94] ..	52
Netherlands: Bacteria Found To Etch Silicon Chips [Amsterdam <i>COMPUTABLE</i> , 15 Apr 94]	52

German University Laboratory Perfects Economical LCD Screens [Paris <i>ELECTRONIQUE INTERNATIONAL</i> HEBDO, 14 Apr 94]	52
German Participant Criticizes JESSI Program [Heinrich Interview; Munich <i>SUEDDEUTSCHE ZEITUNG</i> , 17 Mar 94]	53
Microsystem Technology Status, Prospects Assessed [G. Krause; VDI <i>NACHRICHTEN</i> , No 9, 4 Mar 94]	54

NUCLEAR R&D

France: March Against Superphenix Reactor Organized [M. Castaing; <i>LE MONDE</i> , 10-11 Apr 94]	55
France: Implications of Restarting Superphenix Reactor [Paris <i>LE MONDE</i> , 25 Feb 94]	56
France: Massive Investment Planned for Nuclear Explosion Simulation [Paris <i>LE FIGARO</i> , 23-24 Apr 94]	57
France: Bordeaux May Get Nuclear Test Simulation Laser [Paris <i>LES ECHOS</i> , 18 Apr 94]	58

TELECOMMUNICATIONS

UK: Optical Communications Market Seen Growing [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 2 May 94]	58
EC Telecommunications White Paper Outlined [I. Holt; London <i>MOBILE COMMUNICATIONS INTERNATIONAL</i> , Spring 94]	59
FRG Research Minister Calls for Information Superhighway Initiative [Frankfurt/Main <i>FRANKFURTER ALLGEMEINE</i> , 25 May 94]	62
Developments in German Mobile Telephone Market Viewed [H. Kalt; Frankfurt/Main <i>FRANKFURTER ALLGEMEINE</i> , 8 Mar 94]	62
German Railways, Bundeswehr Use Own Telecom Systems [G. Krause; Duesseldorf <i>VDI NACHRICHTEN</i> , No 13, 1 Apr 94]	63
Germany: 29-32 Billion DM Market Expected in Multimedia Area [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 17 Mar 94]	65
France Telecom Fiber-Optical Refit Outlined [Paris <i>ELECTRONIQUE INTERNATIONAL</i> HEBDO, 31 Mar 94]	65
France Telecom Favors European Approach to Information Superhighway [Paris <i>AFP SCIENCES</i> , 31 Mar 94]	66
France: Alcatel's Long-Range Plans Presented	67
Alcatel Optronics [J. Jolivet; Paris <i>L'USINE NOUVELLE</i> , 31 Mar 94]	67
Joining Globalstar Services [J. Jolivet; Paris <i>L'USINE NOUVELLE</i> , 31 Mar 94]	67
Swedish University Develops Transistor Operating at 380 Gigahertz [U. Karlsson; Stockholm <i>NY TEKNIK</i> , 24 Mar 94]	68
New European ISDN Standard, Future Prospects Viewed [M. Schnurpfeil; Duesseldorf <i>WIRTSCHAFTSWOCHE</i> , 18 Mar 94]	69

EAST EUROPE

DEFENSE R&D

Czech-Slovak-Hungarian Robotic Reconnaissance Plane Developed [Bucharest <i>STINTA SI TEHNICA</i> , Feb 94]	71
Hungary: All Terrain Light Military Vehicle Developed [Budapest <i>HVG</i> , 12 Mar 94]	71

INTERNATIONAL

TELECOMMUNICATIONS

Cyprus: Telecommunications Authority Improvements [F. Vatiliotis; Nicosia <i>HERMES INTERNATIONAL</i> , Spring 1994]	72
---	----

ADVANCED MATERIALS

Germany: Fluorine Gas Promising for Analysis of High-Performance Materials

94WS0289A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 15 Mar 94 p 8

[Article by JB: "High-Performance Materials Can Be Analyzed With Fluorine Gas"]

[Text] Frankfurt—Chemical analysis presents problems when high-performance materials are to be studied for potential impurities. The special properties of these materials, such as high temperature resistance, hardness, corrosion and wear resistance, make sample digestion difficult. The Max Planck Institute (MPI) for Metal Research (Bunsen-Kirchhoff-Strasse 13, 44139 Dortmund) has developed an alternative digestion method, which works with fluorine gas as digesting agent.

As reported by Rainer Garten of the MPI, gaseous fluorine is suitable for many reasons for digesting resistant materials. The gas reacts with many materials as early as temperatures between 400 and 600° C, and it can be purified by distillation. The fluoridation products created in the digestion are volatile and can therefore be studied with gaseous analysis systems. Despite these advantages, sample digestion with fluorine has been little used so far. This is due to the difficult handling of the elements which reacts very easily and to the so far still limited availability of pure fluorine. Now, however, the element can be produced in sufficient quantity and purity.

The digestion takes place in an apparatus made of pure steel and monel. The reactor, in which the fluorine gas reacts with the sample, is of pure nickel. Fluorine combines with the nickel into a nickel fluoride protective layer resistant up to a temperature of 700° C, which protects the reactor material.

The fluorine gas, condensed through cooling with liquid nitrogen, is added to the reactor through vacuum pumps. Subsequently, the reactor is heated to between 400° and 600° and the sample digested. In so doing the pressure in the reactor increases up to 12 bar. The fluorine-containing reaction gases are drawn off through a titanium dioxide absorber. The fluoridated reaction products can then be analyzed according to the degree of their volatility. Fluoridated nonmetals and semiprecious metals are often volatile and can be analyzed with spectrometry methods. Most fluoridated metals are not volatile and are analyzed after dissolving them in mineral acids.

Digestion with fluorine has proved itself particularly for analyzing content materials. Studying purity is especially important for this group of materials, since the properties of the ceramics is greatly influenced by impurities.

Conventional digestion methods are either very time-consuming or falsify the analysis through impurities which occur during the digestion process. But other materials, such as glasses, ferobor, cast iron, plasma spray powder and tantalum silicate, can also be successfully digested with the Dortmund method, it is reported.

German Institute Develops Coating for High Temperature Turbine Blades

94WS0295B Stuttgart BILD DER WISSENSCHAFT
in German Apr 94 p 111

[Unattributed article: "Socks for Hot Blades"]

[Text] The Institute for Materials Research of the German Aerospace Research Institute (DLR) in Cologne-Porz works with the extremely high temperatures of the gas stream in aircraft jet engines. When the turbine blades of modern jet engines are surrounded by a not quite 0.3-millimeter thick thermal insulation layer of zirconium oxide, the gas temperatures from the combustion chambers can be further increased. This is almost the melting temperatures of the turbine blades, which are firmly attached to the turbine axis, however, and thus can also transmit heat.

The goal is now 1,500° for the gas temperature; each 150° increase raises the efficiency of the turbine by about six percent and correspondingly reduces the fuel consumption and generation of pollutants. The DLR researchers do not take into account the cooling of the blades, for example by circulating cool air, since the power gain is then largely eliminated.

When you surround the blades which are under extreme thermal stress with thermal insulation in order to prevent the flow of heat to the metal, the difference between gas and metal temperatures can be further increased. Then, however, the adhesion of the protective layer determines the life of the turbine; if the layer peels off, there is total damage. Using so-called electron-spring jet-vaporization facilities the DLR is trying to overcome the poor evaporation ability of certain elements such as silicon and to enrich materials which increase layer adhesion in the insulation layers.

The constant race between thermal material resistance and higher gas temperature is not unique for jet engines. It began with the first steam engines which drained the mines and in so doing burned at low steam temperatures a large part of the coal that was mined. It was evident even at that time that the efficiency of a thermal power machine is greater the higher the temperature difference between the working gas and the outside temperature.

Germany: Diamond Films Produced From Coconuts

94WS0307B Berlin *INGENIEUR DIGEST* in German
Mar 94 p 21

[Text] Diamond films will control a market of billions by the year 2000 in abrasion protection, electronics and optics. The prerequisite: a way must be found to produce homogeneous films covering a large area more quickly and cheaply.

The first diamond synthesis using ordinary graphite was accomplished by brute force. In the 1950s, researchers from the giant American company General Electric used temperatures of 2,000° C and 50,000 atmospheres of pressure to produce artificial diamonds. This process predominated for a long time. In 1990, 350 billion carats or 70 tons of diamonds, valued at a billion dollars, were produced using this method.

But there are more elegant ways to do it. As early as the end of the 70's, a team around Prof. Dimitri Fedosyev at Moscow University had done pioneering work on low-pressure diamond synthesis. "The technological arrogance of the West prevented us from taking the Russian work seriously," admits Ralph-Juergen Peters, coordinator of the BMFT program for diamond synthesis.

Only the Japanese paid any attention to the pioneering feat. They rapidly modified the process and protected it with a wall of 500 patents.

In CVD (chemical vapor deposition) technology, carbonaceous gas is exposed to high temperatures at low pressures in the presence of hydrogen and deposited as a thick layer of polycrystalline diamond on suitable substrates.

For a few years nothing happened to disturb this process. It was not until the 1980's that the international professional world recognized the true potential of this technology and its possible applications. Intensive efforts at further development began.

Numerous suppliers in Japan and the U.S. are working on the development of processes and marketable products. Companies and governments all over the world have invested several hundreds of millions of dollars. One catalyst is the hope of being able to replace silicon as material substrate with diamond film, at least in part. But at the moment the bulk of the products manufactured with the CVD process are offered in the classical diamond areas: machine cutting and optics.

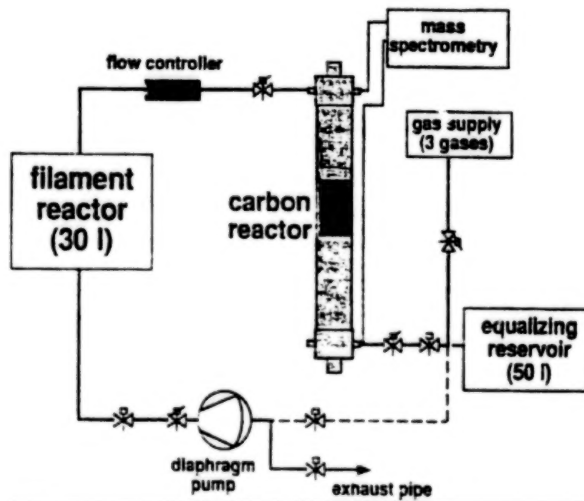
The diamond conglomerate De Beers has been on the bandwagon since the mid-80's. After fundamental experiments in Johannesburg, "several million pounds sterling" were invested in England, according to Dr. James Campbell, chief of the industrial diamond department. The pilot CVD plant on the Isle of Man was transformed

into a production plant. But "because of the stiff competitive situation," Campbell is unwilling to reveal any details about the costs, capacity or processes of the reactors, which have been in use since last June.

In the Fraunhofer Institute for Film and Surface Technologies, IST, Dr. Matthias Fryda and Dr. Claus-Peter Klages succeeded in developing a process, which has already been patented. In this process the hydrogenating gasification of coal makes it possible to produce diamond films both economically and ecologically. Traditional plants have up to 100 liters of processing gas flowing through them per minute. The gas generally consists primarily of hydrogen, with a small percentage of hydrocarbons, of which again only a part contributes to diamond growth. The residual hydrocarbons and all the hydrogen are blown into the open air.

In the process developed in Hamburg "in contrast, the waste gas is reprocessed in a closed circuit with the help of hot activated charcoal," according to Dr. Lothar Schaefer of the IST. "No gas is used up or released into the environment during film production." The process (in outline) provides for the breakup of the hydrocarbons which hinder diamond deposit, and it supplies the necessary methane concentrations for film production. A special property of the process is that under given pressure and temperature conditions a definite hydrogen-carbon gas mix is always produced in the carbon reactor, even when other oxygenated or inert gases are added which encourage diamond separation.

The process is still rather exotic: the German scientists achieved their best results to date with a coal produced from coconut shells. It makes gas streams of up to 25 liters per minute and kilogram possible. Japanese researchers initially chose their national drink, sake, as the starting point for their diamonds.



Germany: BMFT Supports Diamond Film, Cubic Boron Nitride Project

94WS0352A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 2 May 94 p 10

[Article by Franz Miller: "Research Projects Strive for Superhard Diamond and Cubic Boron Nitride Films"; Subheads: "New Technologies to Enhance Tool and Component Efficiency"; "Diamond Coating of Steel Still Not Feasible"]

[Text] Munich—The harder drills and cutting tools are, the longer they last and the more accurately they function. It is mostly sufficient to coat the surfaces with hard films. That saves costly basic material. Using new physical and chemical deposition processes it is now even possible to enhance the physical limits of hardness: diamond, the hardest substance in the world, can be deposited as a thin film on tools. Such new film processes for hard metals have been developed successfully in recent years in Germany as well. It is the intention of a new research project to extend them to steel tools. Until now there are still no superhard films for the processing of ferruginous metals, and diamond is not suited for such a purpose. The hardest alternative is boron nitride. It is the aim of another combined project of the Federal Ministry for Research and Technology [BMFT] to vacuum metallize it as a thin film. By combining diamond films and cubic boron nitride as a supplement, superhard films will become available for all materials and categories of application. Such research projects are supposed to result in a position of international leadership in the application of superhard films. The initial results had been displayed at the Hannover Fair.

Swift technological development is continually elevating the quality and reliability criteria for components. Since the surface is of critical importance for the effectiveness of many tools, it is mostly enough to alter their properties. Further advantages of surface engineering are that energy and material can be economized through an appropriate combination of basic material and film and substitutes can be had for relatively costly basic materials.

This is the reason why in recent years the processes developed in micro-electronics for the physical (physical vapor deposition [PVD]) and chemical (chemical vapor deposition [CVD]) deposition of films from the gaseous phase have been extended to the coating of all sorts of components and tools. Currently coatings are utilized in many engineering sectors: in micro-electronics, in the optical industry and even for the wearing protection of components and tools. It is the aim of these new film technologies to enhance the performance of tools, components, machinery and equipment so that companies can strengthen their competitiveness in the world's markets.

Diamond is an especially attractive material for film engineering. Of all known substances diamond is the hardest, it is particularly resistant to abrasion and it is chemically resistant. Because of its high heat conductivity and its excellent optical and electrical properties it

is a very promising material in the future of micro-electronics. Even the most extreme substance, however, has its weak point: at temperatures over 500° C, approximately, diamond reacts with oxygen, meaning that the precious crystal burns up.

In the early eighties, on the basis of research activities in the former Soviet Union, Japanese researchers developed deposition of polycrystalline diamond films from an active gaseous phase at low pressure. Such CVD diamond films turned out to be excellent wearing protection for tools and components. As a result there was a fresh outbreak of diamond fever, this time in scientists' laboratories. According to market research, as early as the late nineties, the volume of CVD diamond films for tribological applications is likely to swell up to 3 billion German marks [DM].

Two unresolved problem areas are being feverishly worked on: diamond coating of steel and processing of steels in which the diamond films undergo chemical wear because of high carbon solubility.

Steel is such a critical basic material for tools and components that the BMFT has decided to support the "vapor deposition [VD] diamond coating of steel." Participating in the DM9 million combined project, half of which is financed by the BMFT, are the Juelich Nuclear Research Facility [KFA] research center as project sponsor, CemeCon limited company [GmbH], Aachen, as contract coater, Daimler-Benz corporation [AG], Ulm research center, and Siemens AG, Berlin, both of which use steel tools in their firms, and tool manufacturer United Hard-metal GmbH, Horb am Neckar. Coordination of the research and development [R&D] tasking will reside with the Fraunhofer Institute for Film and Surface Engineering.

The basic R&D tasks to be resolved are: the temperatures for the diamond deposition have to be lowered to below 500° C, the diffusion processes between the underlying steel body and the diamond film have to be attenuated and, lastly, adequate bonding of the films has to be realized.

The participating industrial users are hoping for a definite increase in the effectiveness of tools and components with diamond coating and a technical lead over the international competition in equipment and machine building and, ultimately, as a result, economic advantages.

Since there is still an absence of superhard coatings with which ferruginous materials can be treated, the BMFT is therefore supporting a combined project worth nearly DM10 million for concurrent research on "cubic boron nitride films."

Cubic boron nitride (c-BN) ranks alongside diamond among the "superhard" materials. Even the electrical and optical properties are similar to those of diamond. Unlike diamond, which is subject to chemical wear because of its reaction with iron in the processing of steel, cubic boron nitride is eminently suited, even at high temperatures, for the processing of ferruginous

materials. This explains the great interest by industry and above all by tool manufacturers in cubic boron nitride films. Cubic boron nitride's excellent properties also hold forth promising future applications in transportation and energy engineering as well as communications engineering and in the medical sector.

Internationally, however, development in the field of cubic boron nitride films is only at the outset. Activities have progressed the furthest in Japan and in the U.S. One Japanese research group has already succeeded in coating drills with cubic boron nitride. But there are still a number of unresolved questions that have to be resolved before practical implementation. For instance, there is still extensive uncertainty about which processes and coating parameters can produce cubic boron nitride films that are as free from phase shift as possible.

Essential to practical use of cubic boron nitride films for wearing protection in electronics or optics is their excellent bonding. Films of several micrometers' thickness are required especially on tools. This problem has still not been resolved globally. Currently various interim film bonding agents are being tested, but so far this has not resulted in any breakthrough.

The structure of the combined projects indicates the strict industrial orientation of the planned research activities. The partners want to realize a position of international leadership in industrial applications of superhard films. The decisive prerequisite for market success will be the economicalness of the coating technologies. The objective is to be well armed with supertough films in tough competition.

Franz Miller is an employee of the Fraunhofer Society, Munich.

Germany: New Method Used to Develop Heavy-Duty Components Without Lubricants

94WS0352C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 May 94 p 8

[Unattributed article: "Aachen Scientists: High-Precision Heavy-Duty Lathing"; Subhead: "Using New Method Highly Stressed Components Can Be Tooled Even Without Cooling Lubricant"]

[Text] Aachen—Using heavy duty tooling as an alternative to conventional production processes, scientists from the technical college of Aachen have offered evidence that highly stressed components can be tooled even with cooling lubricant by using the new method. Norbert Winands and Karl-Friedrich Koch, fellow scientists of Professor Koenig (chair and laboratory for machine tools and operational instruction and the Fraunhofer Institute for Production technology), introduced the new process of "heavy duty lathing in lieu of grinding."

Whereas cooling lubricant has to be used when grinding, it is possible even to dry tool hardened steel components, for example, with tools of coated hard metal, ceramic cutting material and cubic boron nitride [CBN]. Cooling can be dispensed with in the case of such cutting materials because of their highly elevated temperature hardness and chemical stability. It would even produce unfavorable results since cooling could lead to temperature stresses that in turn entail micro-splinters and edge-notching. Since the absence of cooling can lead to thermal deformation, other designs have to be developed to eliminate heat in the case of precision tooling.

Heavy duty lathing represents a sensible substitute to grinding. Not only is complexity decisive for the choice of the production process, so are the required dimensional tolerance and surface finish of the component. Drawing dies, pressure rams and inner-raceway roller bearings are not only exposed to high mechanical stresses, but they have to satisfy extreme quality standards. Consequently, the production stages of such components are costly and numerous.

Heavy duty lathing appears an attractive alternative since it is possible to realize accuracies of International Standards Association [ISA] Tolerance [IT] six and surface finishes from return to zero [Rz]—two to three micrometers using dry tooling. Such grinding values, however, still are not up to the highest precision standards. One significant advantage of dry tooling using geometrically defined cutting is doing without ecologically questionable cooling lubricant. Acquisition and disposal costs have soared, justifying an equivalent replacement even in terms of competitiveness. From a production engineering optic, the high flexibility of the process yields its most important aspect since non-form-bound tools are employed. When grinding, for the most part, each tooling operation uses a process adapted for it. That is why a number of chuckings are frequently required for the tooling. In the case of heavy-duty lathing even complex component shapes are produced with a single chucking.

Such high process flexibility results in shorter throughput times and can be used in both small batch production and in mass production. Using heavy duty lathing it is currently possible to realize dimensional tolerances that previously were reserved for grinding. Cases from industry verify that substituting heavy duty lathing for grinding can yield not only ecological but also economical advantages. As much as a quintupling of basic quantity is feasible coupled with definitely shorter production times. This even holds true if the costs of disposing of cooling lubricants and wheel swarfs are left out of the equation.

Fresh and further developments in the production resources sector, such as machine tools running on fully hydrostatic bearings and magnetic tension designs, in the future, will allow final cutting processing of hardened components having production tolerances that can currently be realized only with cost intensive precision grinding or honing operations. Hence heavy duty cutting opens up new prospects for currently proven production processes.

French Firm Develops Aluminum/Ceramic Composite

94WS0317B Paris INDUSTRIES ET TECHNIQUES
in French Mar 94 p 91

[Article by Emmanuel Jullien: "To Make High-Strength Cylindrical Parts: A 50/50 Aluminum/Ceramic Composite"—first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] The method developed by Industrial Bronzes, a small to mid-size industry [PMI], yields aluminum-based composites with a very high wear resistance.

When it manufactures metallic rings and cylinders by centrifugation, the PMI Industrial Bronzes kills two birds with one stone. Actually, it uses centrifugal force to achieve concentrations of up to 50 percent of silicon carbide particles in its aluminum parts, over a thickness of its choice, and in parts ranging from 80 mm to 2 m in diameter. This is an original way of exceeding the 20-percent rate, above which the alloy becomes too viscous to be cast.

"When silicon carbide concentrations reach 30 percent, the aluminum-matrix composite becomes practically insensitive to friction, its mechanical performance improves, and it can withstand temperatures as high as 300°C," Luc Lajoie, the technical manager, explained. This means a tenfold increase of the application range of light-alloy cylinders. Aerospatiale already placed a test order for space applications. Sollac also decided to subject the alloy to severe testing, using it for an electric collector ring immersed in water heated to over 100°C.

It was after the completion of the Euram BRITE [Basic Research in Industrial Technologies for Europe] project, completed jointly with the Grenoble National Polytechnic Institute (INPG) at a cost of 12 million French francs [Fr] over three years, that the PMI developed this knowhow. The manufacturer makes an aluminum alloy containing 10 percent of silicon carbide, and centrifuges this alloy to mold it into a cylinder. Being heavier than aluminum, silicon carbide then migrates toward the outer perimeter. There, it accumulates in concentrations of 30, 40 and even 50 percent. "By varying the temperature and centrifugation rate, we manage to control the concentration and thickness of the solidified zone. But we also vary the particle size (from 10 to 100 fm) to modify the mechanical strength and wear resistance," Luc Lajoie added. Another distinctive characteristic is that the parts are strengthened both at the surface and throughout their thickness. Witness the tests carried out on engine cylinder liners, causing silicon carbide to migrate and accumulate in a 5-mm thick homogeneous peripheral zone containing 35-percent silicon carbide. After the cylinder has cooled, its inside must be machined to remove about 10 mm and get down to the strengthened zone. "Compared with the 'Nicasil' surface treatment (using nickel and silicon carbide), the price is divided by two," Luc Lajoie assured.

France: Researchers Make Material Breakthrough

BR1204082694 Paris SCIENCES ET AVENIR
in French Apr 94 pp 16-20

[Sylvestre Huet report. "A New State of Matter"]

[Text] "Here is the machine," says Alain Perez, indicating with a rapid gesture a fat cylinder of polished steel. Dotted with metal studded inspection portholes, draped with power cables, lit by a flashing green laser beam, and surrounded by display monitors, it looks just like any another laboratory. In the basement of the Claude Bernard University in Lyons, accessed by a narrow corridor, there is nothing to indicate to the visitor that what he has before him is a machine unique in Europe. Nonetheless, it plays a key role in the study of material in grains so small that you can almost count the exact number of atoms—what the experts call aggregate structures. This intermediate state of matter, known scientifically as mesoscopic, comes between the atom (or the molecule) and the larger compact solid. Rich in new properties that probably lie at the heart of macroscopic phenomena—crystal growth, conduction, magnetism—until recently aggregates had been an enigma for physicists. Hard to produce—in small ovens—they had been ephemeral, giving just enough time for a small peek and a rapid analysis. Times have changed: physicists have now managed to tame them.

Here they are produced by a combination of the two extremes of very hot and very cold: burning laser shots and cooling jets of helium. The heat of the laser is powerful enough to vaporize even the most heat-resistant of substances, such as carbon which requires a temperature of 4,000° C. Helium—or argon—injected at the same frequency as the laser pulses, expands and leads to a sudden and violent refrigeration to around 0K (-278° C). The aggregates are thus not given enough time to recombine with their neighbors.

They are analyzed by their "flight" in the machine. This is common practice, and is also used at Lyons to sort them by mass. Then, after they have been sorted, the less common practice is performed of spreading them out in layers on thin plates. Only a few laboratories can do this, notably the AT&T laboratories in Murray Hill in the United States, and the federal polytechnique school in Lausanne, Switzerland.

Physicists rarely lack the adjectives to qualify matter: "condensed," "soft," and now we have "divided," to use the word employed by experts in aggregates and adopted by Michel Broyer. Professor, laboratory director, and master in the art of analyzing aggregates by the duration of their flight through the vacuum, he sums up in one sentence the aim being pursued: "to clarify the behavior of matter when it is prevented from forming a compact solid." In short, a little pile of atoms—from three or four to a thousand—of iron, nickel, silicon, cobalt, or carbon. Things can also be complicated slightly by using piles of assemblies of two types of atom. At a time when nuclei are smashed into a thousand pieces to determine their

constituents, there is still much we do not know about the properties that these aggregates could reveal. How are they formed? What shapes do they take? What happens to their electrons? In thin layers, are they hard or soft, conductive or insulating? Will they prove useful for chemists, interesting for electronic engineers, or revolutionary in optical electronics? Used as projectiles, could these microscopic shells destroy a target substance?

There are so many questions that the theorists remain rather guarded. Verbose on the subject of nuclei, specific on single atoms, they have little to say when it comes to this divided matter. This is an ideal situation for the three promoters of the Lyons pole and their experimental approach that has turned up so many surprises. Michel Broyer stresses: "We explore." The theorists can calculate the shape of an aggregate of up to 10 silicon atoms, but more than that, and they can only draw on approximate notions or theories for as long as there are not enough atoms to speak of a compact solid. Alain Perez is director of research at the National Scientific Research Center [CNRS], charged with designing and developing the source of aggregates in association with the Lyons group. He says: "Few predictions are possible in this domain." With his group and the group headed by A. Hoareau, the materials expert started the adventure with a gamble: No one could say for sure whether the aggregates would keep their specific structures and properties when they were deposited in layers on a substrate. Would they not, rather, "lose the memory" of their violent and imbalanced formation and reform as a conventional substance?

The last of the three men, Albert Renouprez, leads a team in a chemistry lab close to the Claude Bernard University, specializing in catalysis. Chemists and aggregates go back a long way. The reactors in the oil industry have been using aggregates for a long time to crack long hydrocarbon molecules. They are commonly used in perfume manufacture and pharmacy. A recent CNRS report estimated that at least 20 percent of the GDP of the United States is generated from activities relating to substances obtained by catalysis. However, their production by chemical means—as a platinum salt deposit on a plate and then stripping the salt off—is certainly efficient, but it remains essentially an empirical process. It is difficult, in these conditions, to identify the chemical processes at work, and especially difficult to invent recipes based on new elements or mixed aggregates. Albert Renouprez admits: "We know absolutely nothing about the chemical properties of this type of aggregate." He has just obtained, using the vaporization source, the first samples of mixed platinum and palladium aggregates on silicon and graphite substrates. He sees the adventure leading to the possibility of working on "model" aggregates that could, perhaps, be applied to the catalytic exhausts of the future.

Michel Broyer leads the way in this exemplary project of cooperation. It is his team at the ionic and molecular

spectrometry laboratory (CNRS/Claude Bernard University) that is charged with identifying the aggregates formed in the vacuum chamber. The efficiency of the equipment in Lyons has sped up the research. When subjected to analysis, the aggregates reveal their secrets.

In addition to their shapes and construction, physicists are interested in the properties of these aggregates. How many atoms does a metal need to conduct electricity? There is no theoretical answer to this question.

Catherine Brechignac of the Aimé-Cotton laboratory in Orsay (CNRS coordinator of French teams working on aggregates) and Michel Broyer conducted experiments with mercury aggregates in the Orsay Lure laboratory for the use of electromagnetic radiation to study the transition from insulator to conductor in relation to the number of atoms. They saw that as long as there are less than 12 atoms, excitation remains limited to just one. The "current"—a shared behavior affecting an electron population—does not flow. From 12 atoms, the interaction between them intensifies and their electronic fields interconnect. Over 80 atoms, and electrons are knocked out of place. However, we need at least 1,000 atoms before we can really speak of electrical conduction. Even on this scale, the electrical and chemical properties of the aggregates are not always the same as those of the solid substance. Going one stage further, Michel Broyer is now examining "mixed" aggregates, cautiously combining the simplest of metals, lithium, with the simplest of atoms, hydrogen. The aggregates obtained consist of eight to 15 lithium atoms and one or two hydrogen atoms. He has discovered that the latter tend to form on the aggregate's surface.

While Michel Broyer's team is refining its methods for precisely determining the aggregates produced, Alain Perez's team has been preparing the plates. After a relatively stringent sorting process, these plates capture aggregates at the end of their trajectory forming, in one hour, plates of up to a thousand angstroms thick over an area of one square centimeter. He exclaimed: "What we had hoped for has happened! The aggregates retain the memory of how they were formed and land unaltered on the substrate. This is a world first that opens up a whole new avenue of research." The initial guinea pigs were widely reported in the media, including the famous fullerenes (assemblies of carbon atoms, some of which—between 20 and 60 atoms—grouped together in little balls or even footballs). "In fact we have managed to isolate a whole series of families—from the spherical and never-before seen C₂₀, to the C₉₀₀—which we chose because of their specific characteristics."

Alain Perez talks enthusiastically of "an ideal technique for producing thin, nanostructured layers." The prefix nano is currently the vogue in laboratories, a sure sign of physicists' ambition to be able to manipulate matter one atom or one molecule at a time. The layers of carbon aggregates are organized in piles of spherical particles some 15 to 25 nanometers in diameter, as seen in atomic

microscopes. Alain Perez manufactures strange "nano-sponges" on the surface of his plates. They combine the perfect order of aggregates at a short distance with the disorder of the layer where the aggregates are deposited at random. This crystalline/amorphous mixture can result in new and interesting electrical, magnetic, and optical properties. Alain Perez actually speaks of "new substance." The C20 nano-sponges, insulating and transparent, are almost as hard as diamond but have less than half the density, making them similar in mass to polymers. With aggregates of iron 20, iron 150, and nickel 200, the magnetic effects of the nanostructured layers differ considerably from solid substances. Alain Perez talks of a ferromagnetic state midway between amorphous and crystalline substances. It is possible that his small packets of aggregates, whose magnetism can be controlled, are the precursors to future, hyperdense magnetic computer memory.

Other teams have shown that nanoporous layers of silicon are luminescent in the visible spectrum, although nobody really knows why. Will optronics engineers be able to use this phenomenon? Alain Perez insists: "Not all these properties could be deduced from the properties of aggregates. However, the initial experiments on carbon will serve as a reference for our future research on silicon." He is looking to build silicon aggregates with less than 30 atoms. Some theorists predict that they will be compact, with layers more dense than are found in solid blocks of the substance, thus producing a new metal phase... To summarize expert opinion, the last CNRS economic report speaks of the "major stakes" that are represented by thin layers of aggregates.

Four hundred km from Lyons, another French team has declared war with aggregates. Figuratively (since it has just embarked two major scientists) and literally, as it aims to accelerate aggregates and use them as a shell to bombard matter with. A change of scenery, with big machines and warlike vocabulary. On the Orsay campus, the physicists working on the Tandem electrostatic accelerator—a blue-colored machine some 30 meters long, built at the start of the 1970s—have seized on these new projectiles. Accustomed to working with atomic ions, their job is to observe the reaction of a bombarded substance through the behavior of individual atoms. Using energy of around 100 million electron volts, they force the bombarded substance to emit ions, or even molecules in the case of organic matter, which can then be analyzed for identification.

Standing by the blue Tandem machine, supervisor Serge Della Negra is almost apologetic: "Of course, we cannot see anything, but Orion is in there." Orion lives up to its name. In its designer's view, it is a real "spatial manipulation." The original and risky idea consisted of introducing an aggregate source into the accelerator and leaving it there for several months. It has to resist a hostile environment of electromagnetic storms and an insulating gas at a pressure of 9 bars, while obeying the commands relayed by optical fiber. Everything is done without the possibility of entering Tandem to carry out

repairs. Serge Della Negra admits that "the risk was that no one could be sure that the aggregates would resist the acceleration and not split up." However, it was worth it. "At the end of the trajectory we bombard a point of material with a huge amount of energy generated by the weight of the new projectile." By switching from the ionic atom to the aggregate, in effect the physicists swapped a ball for an explosive shell.

The first weapons used were C60 molecules, supplied in powder form by the CNRS's "Mr. Fullerenes," Patrick Bernier. In 1992, Serge Della Negra's team surprised everyone using a beam of C60. Introduced into the Tandem at 200,000 electron volts, this was then accelerated. It passed through a box of nitrogen like a kamikaze and ionized to come out the other side at 40 million electron volts! Serge Della Negra says: "It is true that we lose 999 out of 1,000 C60's in the process, but it is a world first, and no theorist could have calculated the interaction between C60 and nitrogen."

If he sounds jubilant it is because the bombardment obtained opens up a whole new perspective. The largest known deposition of energy per unit of time and space was performed in the GANIL heavy ion accelerator in Caen, using uranium beams. With a beam of one billion electron volts, it delivers 3,000 electron volts per angstrom, but over hundreds of microns since atomic ions penetrate substances easily. On the other hand, C60 aggregates cannot slip between atoms and instead cause real explosions on the surface of the material. With this experiment, the Orsay physicists have nipped in the bud the theory that it is impossible to accelerate C60 aggregates in a machine such as the Tandem. However, the low yield obtained meant that the problem had to be reworked. They then attempted to use gold aggregates, so producing the first ever precious metal explosive shells.

On 19 November 1993, the Tandem team in Orsay was therefore able to post another world first: the acceleration of aggregates of three or four gold atoms. Aggregate beams with an energy of 10 million electron volts bombarded silicon sheets, creating shock waves that changed the crystalline structure of the silicon.

What can be done with this new technology? Apart from its interest from the point of view of basic research, Serge Della Negra is convinced that there are other openings: "Microelectronics, surface analysis and treatment, nanostructures, multipoint bonding, biochemical detectors, etc. A number of possibilities can be envisaged, as long as we are not restricted to the specific conditions of the physics experiment," and, a CNRS report stresses diplomatically, as long as French industrial groups do not continue with their "wait and see" policy.

In the longer term, Serge Della Negra is also thinking about thermonuclear fusion. For some time, scientists have been searching for a way to prevent the deuterium and tritium nuclei from fusing by compressing them (by "inertial confinement") using converging laser beams. In a kind of heavy arms race, we are moving from photons

to protons, and then to atomic ions, and finally to aggregates. The heavier the projectile, the more violent the impact. "We are still a long way off. However, we are getting ready for the time when we will be able to accelerate to 10 million electron volts molecules of 100,000 atoms ionized a hundred times, which would generate a billion electron volts in 1,000 angstroms, the scale required to achieve fusion."

With the successes achieved at Lyons and Orsay, a number of teams are starting to perform this type of experiment. Researchers have been able to successfully apply the concepts of nuclear physics to aggregates. However, Serge Della Negra laments: "Divided matter does not have its De Gennes, like soft matter." Not yet.

The Geometry of Aggregates

Cuboid octahedrons, tetrahedrons, octahedrons, icosahedrons, etc. Freed from energy constraints and thus from the constraints of the crystalline networks of solid matter, aggregates have taken new shapes. The physicist invents assemblies of atoms in shapes encountered nowhere else in nature except in interstellar space. Michel Broyer has discovered that it is possible to alter the shapes produced by altering the pressure of the helium and the nozzles that supply it, generating effects that differ according to the melting point of the elements. Aggregates of more than 100 aluminum atoms prefer octohedrons. Gallium aggregates collect in the shape of a drop of liquid, with electronic layer effects such as would exist around an enormous atom. The Lyons researchers also hold a record: gallium aggregates with an outside layer of 7,200 electrons. Indium aggregates of less than 200 atoms take up this droplet shape, while they resemble aluminum when there are more atoms. Nickel, iron, or cobalt aggregates have more rigid shapes. Nickel and cobalt, in aggregates of 100 to 900 atoms, adopt an icosahedron shape. The aggregates of iron take a number of different shapes.

Breeding Aggregates

First take a thin bar, a few centimeters long by a few millimeters across. It may be made of ultra-pure iron, cobalt, carbon, silicon... in fact the whole of the periodic table is available. Placed in a vacuum chamber, this little bar is then spun round in the heat of a Yag laser pulsed at a frequency of 30 Hz. The power of the laser vaporizes some of the material. At the same time, synchronized with the laser pulses, a jet of helium is pulsed into the vacuum chamber. When it expands, the helium immediately cools the vapor which then "freezes" the aggregates formed, even if they are far from being in a state of energy balance. Carried along at supersonic speed, the ionized aggregates are sent to a "flight time" line, where they are identified by mass spectrometry. This is the field of research of Michel Broyer and his team. When production is known and calibrated, the deposition stage commences. After passing through a chamber sorting the number of atoms—applying Cornelian selection: the more severe the sorting the fewer aggregates remain for

deposition—the aggregates enter a deposition chamber. The first type of chamber is used by Alain Perez's team in the materials physics department (CNRS-university), since their plates often have to withstand exposure to air. The second type of chamber, which includes a small vacuum "suitcase" protecting the deposit from chemical reactions, is used by Albert Renouprez at the Catalysis Institute.

The only source of aggregates in Europe, this system is characterized by a high flow and the ability to deposit on a substrate aggregates that have been sorted by mass. It was financed by the CNRS, the Claude-Bernard University (Lyons), the French research ministry, and the Rhone-Alpes region for 10 million French francs (1989-1993). The second source, currently being installed, will benefit from an acceleration cavity making it possible to bombard a target with heavy aggregates with an energy of 1,000,000 electron volts.

Swedish Navy Tests New Ultra-Light Stronger-Than-Steel Shafts

BR2204141494 *Toddington NEW MATERIALS INTERNATIONAL in English Apr 94 pp 2-3*

[Unattributed article: "Shafts Cut Weight by 70 Percent in Naval Use"]

[Text] Shafts made of a new composite material which is stronger than steel, reduces the weight up to 70 percent and lowers installation and maintenance costs, have been introduced by Applied Composites in Linköping, south Sweden. The new composite, made of carbon fibers, aramid and glass fibers, is in use in an experimental craft, called Smyge, a stealth vessel for the Swedish Royal Navy.

Shafts installed in Smyge, which has undergone four years of extensive tests, have shown no signs of fatigue. According to laboratory tests, shafts made of carbon composites transmit over 10 times more torque by weight than a steel shaft, or about 3,300 Nm per kg compared to 150 Nm per kg for a steel shaft. Nor is it necessary to change the transmission system for the installation of composite shafts which are available in a standard production range of 6.5 meters or more in length and up to 2 meters in diameter.

By combining different types of fibres and varying the angles, shafts can be tailor-made for different purposes. Using filament winding it is possible to make the composite shafts stronger than steel said the company, which is part of the Celsius Group, the leading Swedish defense industry. The fibers most commonly used are glass, carbon and aramid with epoxy or vinylester resin.

As composite shafts have a much higher critical speed than conventional metal shafts, they can reduce or eliminate the need of bearings.

Composite shafts are non-corrosive, non-magnetic, non-conductive and have higher damage tolerance and

reduced vibrations. They can be used as drive shafts, wheel shafts, rudder shafts and rods.

Weight reduction is one of the most important properties of the composite shafts; a traditional metal shaft with a weight of about 7 tons can for example be substituted by a composite shaft weighting approximately 300 to 400 kg.

AEROSPACE

France: Ariane 5 MPS Motor Body Passes Structural Test

BR1204094294 Paris LA LETTRE DU GIFAS
10 Mar 94 in English pp 1-2

[Unattributed article: "SEP: Structural Qualification Testing of the Solid Fuel Engine of the Ariane 5"]

[Text] A key phase was passed on 11 February 1994 in the development of the MPS (Solid Fuel Motor), the solid fuel power plant of the Ariane 5. CNES [National Center for Space Studies] has commissioned Europropulsion (a subsidiary of SEP [European Propulsion Company] France and BPD [Fiat group] Italy) with the project. Working out of the MPA University of Stuttgart, Man Technologie of Germany, in charge of developing the body of the engine, submitted the metal structure of the engine (the most powerful powder burning engine ever built in Europe) to structural qualification testing at limit internal and external loads up to rupture point. Preparation of the model and procedures had been handled by Man Technologie and Andritz (Austria) under prime contractorship of Division Propulsion of Haillan Powder and Composite Propulsion Division. The one-month test period illustrated the ability of the motor body to withstand, with the required margins, all stress generated on the ground and in flight by the MPS and Ariane 5 space rocket. Rupture occurred under a pressure of 92 bars (1.4 times normal engine operating pressure) in accordance with the anticipated scenario.

For the third fire-up test of the MPS now being prepared at Kourou, engine attachment to structure will be representative of flight configuration. The qualification testing of 11 February 1994 constitutes the green light of Europropulsion to continue this preparation work. The Ariane 5 is a program of the European Space Agency which has commissioned CNES with technical and financial management.

France: Airbus to Study Very Large Aircraft Project Independently

94P60251A Paris LE MONDE in French
10 May 94 p 23

[text] Mistrust prevails between Europeans and Americans over the very large passenger aircraft project. Consequently, on Saturday 7 May, Claude Terrazzoni, Aerospatiale Aircraft Division's director, said that in the coming weeks Airbus Industrie will begin the second

phase of studies on the project named A3XX, without interrupting the feasibility study it is engaged in jointly with Boeing. Three of the world's great manufacturers (Boeing, Airbus, McDonnell Douglas) work on this program: in no way will one be caught napping by the competition.

At the moment, the project is in the very preliminary feasibility study phase. According to Aerospatiale, the market, mainly in the Asia-Pacific region, could accommodate a 60-craft annual production by 2010 and support this pace to 2020. The French aircraft builder—according to Mr. Terrazzoni—is afraid that cooperation with Boeing could be just a "deceptive ploy." Two months ago, this cooperation has been received with some skepticism by the European manufacturer, which is worried about losing its full liberty of action.

Today, the French fear that the Americans will launch their own craft based on the 747-400. They feel that Boeing's recent announcement to build an extended-range 777 two-jet version, has confirmed their suspicions. According to Mr. Terrazzoni, this aircraft "would compete directly with the existing B747-400 four-jet craft, which will force Boeing to modify the B747-400 and begin studies on a new larger aircraft." The French have clearly decided not to let this market pegged at \$220 million (1.25 billion French francs [Fr]) escape them. But, for the moment, only two companies (British Airways and Singapore Airlines) have shown interest for an aircraft larger than 500 seats.

France: Airbus Adapts A300, A310 for Military Transport

94WS0273A Paris AFP SCIENCES in French
3 Feb 94 p 12

[Unattributed article: "Airbus Working on A300 and A310 Adaptations for Military Transport"]

[Text] Paris—Three partners of the European Airbus consortium are working to adapt the A300 and A310 wide-body commercial aircraft for military transport and refueling; they thus hope to find an outlet for second-hand aircraft and a market for new replacement aircraft.

Shown last week at the Singapore Aeronautical Show, the MRTT (Multi-Role Tanker Transport) has a market estimated at 110 units worldwide by the year 2010, according to Aerospatiale—one of the three project partners with Deutsche Aerospace (DASA) and British Aerospace (BAe). The fourth consortium member, CASA [Spanish Aeronautical Engineering Company] does not participate in the study.

The project promoters hope that the airlines that will sell some of their old A300 or A310 to be retrofitted for military purposes will replace them with more recent aircraft, ranging from the A320 to the A340 and including the A330 twin-jet.

According to Mr. Louis Gallois, the Aerospatiale president, the MRTT is said to be developed mostly for France and Canada, which need military transport aircraft. Singapore might participate in the program if the country is interested in the MRTT. "But we need a number of orders before we can launch it," Mr. Gallois added without mentioning any precise figure.

For the time being, this market segment is dominated by U.S. aircraft that are about 40 years old: the KC135 (derived from the Boeing 707) and the KC10 (derived from McDonnell Douglas's DC10).

The MRTT might be offered in several versions: in-flight refueling, military transport (up to 270 soldiers), cargo transport, and all-purpose versions. According to Aerospatiale, it might be available by the middle of the decade.

This program, however, should not interfere with the FLA (Future Large Aircraft), the military transport aircraft for which feasibility studies were started in November by the Airbus partners and several other groups: the Turkish Tusas, the Portuguese OGMA, the Belgian Flabel, and the Italian Alenia. "We do not think that there will be any interference, as the FLA will be tactical and the MRTT logistic," a project official at Aerospatiale indicated.

France: Aerospatiale Reports Smaller 1993 Losses

94WS0292B Paris AFP SCIENCES in French
17 Mar 94 p 10

[Unattributed article: "France: Aerospatiale Reduces its Losses in 1993"]

[Text] Paris—The state-owned Aerospatiale [National Industrial Aerospace Company] group reduced its losses to 1.42 billion French francs [Fr] in 1993 (group share), compared to a negative result of Fr2.38 billion in 1992, in a "very depressed" aviation market, according to an announcement by the French group on 16 March.

Operating losses were reduced from Fr1.218 billion in 1992 to Fr258 million. Net indebtedness was reduced by Fr3.2 billion to a total of Fr13.3 billion before posting the capital allocation of Fr2 billion from the state. Turnover was down 3 percent in 1993 to Fr50.8 billion (-4.5 percent in terms of a constant "perimeter" and at the same dollar rate).

The sharp increase in the value of aircraft deliveries is explained by the fact that "sales of the A340 got up to speed, a circumstance which," according to Aerospatiale, "partially offset the sharp decline in the case of helicopters, the halting of the Hades program, and suspension of the Hermes project."

The year 1994 "will probably not see significant cyclical improvement," says Aerospatiale. The group feels that it "maintained or even strengthened its market share in 1993" and that it did so despite "the very difficult situation of the airlines and the existence of overcapacity in their sector." The state-owned group also draws attention to "the intense competition in military markets, which are being subjected to budget restrictions."

Aerospatiale, BAe, DASA To Cooperate on Concorde Successor

BR0905102194 Paris AFP SCIENCES in French
14 Apr 94 p 12

[Unattributed report: "Aerospatiale-BAe-DASA Agreement on Supersonic Research"]

[Text] Paris—On 7 April, Aerospatiale announced that aircraft manufacturers Aerospatiale (France), British Aerospace (BAe) and Deutsche Aerospace have signed an agreement protocol for a joint supersonic research program.

The purpose of the European Supersonic Research Program (ESRP), which will be financed equally by the three parties, is to define the basic design for a future supersonic aircraft that might succeed the Concorde.

For the time being there are no plans to develop an actual supersonic aircraft. The project aims simply to choose the minimum specifications which will then enable significant research to be done.

The main specifications are a range of 10,000 km, a capacity of 250 passengers and a top speed of Mach 2 (2,250 km per hour).

With this initiative, the three manufacturers hope to create a center of European research that can compete with the work being done in the United States and Japan, and in a few years bring European research to almost the same level as in these two countries.

Last year, just \$15 million was spent on supersonic research in Europe, as opposed to \$60 million in Japan, and \$108 million in the United States.

With their joint effort, Aerospatiale, BAe, and DASA also place themselves in a better position to negotiate their future participation in the development of a second generation supersonic aircraft that will probably mobilize manufacturers on all three continents. The development of such an aircraft is estimated to be worth around \$12-15 billion (with a potential market of around 500 to 1,000 aircraft). According to the three groups: "Just one type of supersonic aircraft will be developed," for reasons of commercial viability.

France: CNES 1994 Budget Announced

94WS0292A Paris AFP SCIENCES in French
17 Mar 94 pp 7-9

[Unattributed article: "France: CNES 1994 Budget of Over 11 Billion Francs"]

[Text] Paris—The CNES [National Center for Space Studies] budget for 1994 totals 11,039,554,000 French francs [Fr]. Officials at the French space agency consider it a "good budget" and one that underscores the fact that "as far as the political authorities are concerned, space remains a priority," according to a statement by CNES President Rene Pellat at the agency's annual press conference on 16 March.

With a civilian and military space budget accounting for 40 percent of the amounts being invested in space by Europe, "France remains the European leader in that area" and must keep that role within the ESA [European Space Agency], Pellat added. The CNES is nevertheless going to place a ceiling of some Fr5 billion on its

participation in ESA programs pending a reformulation of European space policy, which "should be decided on in mid-1995 during the next ministerial conference."

"That ceiling is not the result of an anti-ESA stance," Jean-Daniel Levi, general director of the CNES, pointed out. "Our participation in that agency will remain as it is; it will always be a compromise between our national programs and those of the agency." Pellat emphasized that the agency "is essential to Europe, but it cannot carry out military programs, whereas we must do so."

Of the total Fr11.039 billion—program authorizations (Fr8.4 billion), ordinary expenditures (Fr875 million), and own funds (Fr1.764 billion) combined—47.95 percent will be used for French participation in the various programs of the ESA, to which France, along with Germany, is the biggest contributor; 5.65 percent will be used for bilateral cooperation with countries such as the United States and Russia; 19.44 percent will be used for the national program; 15.06 percent will provide operating support for the programs; and 11.9 percent will be used for general operations, Levi said.

1994 Budget by Major Projects (Subsidies) (in millions of French francs)

Program	1993		1994		Change in			
	Total	Subtotal	Total	Subtotal	millions of French francs		percent	
					Total	Subtotal	Total	Subtotal
Access to space	3,998		4,148		150		3.8	
Infrastructure programs:	485		624		139		28.7	
Columbus		59		209		150		254.0
MSTP [Manned Space Transport Program]		416		389		-27		-6.5
DRS [Data Relay Satellites]		9		25		16		172.3
Space transportation:	3,513		3,524		11		0.3	
Ariane-5		2,720		2,720		-		-
CSG [Guiana Space Center]		601		612		11		1.8
Miscellaneous		192		192		-		-

Despite abandonment of the Hermes spacecraft program in 1992, Fr4.148 billion (an increase of 3.8 percent over 1993) are earmarked for "access to space"—that is, the development of Ariane rockets, ATV [Automated Transfer Vehicle] and CTV [Crew Transport Vehicle] capsules, and the Columbus module.

Scientific activities will receive Fr1.704 billion (+6.4 percent), applications (telecommunications, observation, and so on) Fr1.087 billion (+7.9 percent); rockets derived from Ariane-5 (first flight scheduled for October

1995) Fr485 million, and support for current programs and operations Fr772 million (-4.2 percent).

The Ariane-4's "will be even better when launchings resume at the end of May or the beginning of June" following completion of the modification program scheduled following the failure of the 63d Ariane on 24 January, according to Pellat. As for development of the Ariane-5, it is continuing normally following the three tests in 1993. The M-3 test on the P-230 propellant stage is scheduled for June—with the M-4 and M-5 tests to follow in September and November using a new batch of propellant.

1994 Budget by Area (Subsidies) (in millions of French francs)

Area	1993	1994	Change in	
			millions of French francs	percent
Access to space	3,998	4,148	150	3.8
Science	1,601	1,704	103	6.4
Applications	1,007	1,087	80	7.9
Preparations for future	471	485	14	3.0
Program and operations support	806	772	-34	-4.2
Value-added tax	239	204	-35	-14.6
Total	8,122	8,400	278	3.4

Also scheduled for June is a test with a reinforced structure for the Vulcain cryogenic engine and its tubing. In November there will be a test with a real structure and two propellant stage mockups. In April, and then in Germany in October, there will be tests on the upper stage of Ariane-5. For their part, qualification tests on the nose cones are continuing in the United States. They will be followed by tests on the mechanical mockup of the complete launcher at the Guiana Space Center in Kourou.

In cooperation with the ESA, the CNES has already begun evaluating a further development of the Ariane-5 for beyond the year 2000 that should make it possible to launch a double load of up to 7,400 kg, or 1,400 kg more than with Ariane-5. And in cooperation with Italy, it is studying the need for a small European propellant-fired launch vehicle capable of placing one metric ton in polar orbit at an altitude of 700 km.

The Americans and Russians are still the CNES' two big partners when it comes to bilateral cooperation. Financial difficulties at the Russian Space Agency (RKA) make it somewhat doubtful whether it will be possible to carry out the French-Russian Mars-94 mission at the end of the year, given the economic problems being experienced by the Russians. As for the three scheduled flights by French cosmonauts between now and 2000, it will be necessary to renegotiate them with the RKA, since the last two were to have taken place on the future R-Alpha international orbital station.

It is expected that the cosmonaut for the Cassiopee flight in 1996 will be named in mid-1994. The choice will be either Dr. Claudie Andre-Deshays or Jean-Pierre Haig-nere. Two other French astronauts will participate in space flights or undergo training with NASA: Jean-Francois Clervoy, representing the ESA, is scheduled to fly on board the Atlantis space shuttle next October, and Jean-Jacques Favier, the CNES alternate for the IML-2 mission scheduled for July, will fly on the Columbia.

Summary of Credits for Bilateral Cooperation

Country or agency	Astronomy and exploration of solar system	Telecommunications	Earth and environmental sciences plus data collection	Export activities	Manned flights	Total (millions of French francs)
United States	21.100	-	116.900	-	57.600	195.600
CIS	68.200	-	11.400	-	78.000	157.600
ESA	63.600	1.610	40.000	-	13.000	118.210
Germany	-	9.215	-	-	-	9.215
Various countries and common expenditures	17.100	-	70.500	10.000	25.900	123.500
Total	170.000	10.825	238.800	10.000	174.500	604.125

As far as applications at the national level are concerned, the CNES is continuing to participate in preparations for the next two satellites, Telecom-2C and Telecom-2D. The former is to be launched in 1995 and the latter in 1996. Added to that, if approval is forthcoming, will be work on the major civilian and military telecommunications satellite program outlined in Yves Sillard's report.

The CNES is also continuing to follow up on definition of the Spacebus-2000 and Eurostar-3000 platforms for geostationary satellites in the 21st century and on the spin-off from the satellite optical link program (SILEX). It has also begun studies aimed at a technical definition of the future positioning and data collection system that will replace Argos.

In the area of earth observation, Spot-4 (lifetime: five years) is scheduled to be placed in orbit in 1995. Spot-5 has not yet been ordered, nor has the decision been made to produce new second-generation military Helios satellites to replace Helios-1 and Helios-2, the first of which is scheduled for launching by Ariane at the end of 1994 or the beginning of 1995.

Added to those typically French programs are the programs being carried out through international cooperation in connection with the environment, studies of global climate, and ocean studies: ERS, Envisat-1, and Topex-Poseidon.

Parallel with that in the scientific area, the French space agency is carrying out numerous programs with the ESA, the Russians, and the Americans. In particular, the Pronaos submillimetric telescope is to be launched from a balloon in Arizona in September.

France: Matra Marconi Space To Build New EUTELSAT

94WS0294A Paris AFP SCIENCES in French
31 Mar 94 p 10

[Unattributed article: "Green Light for New EUTELSAT Satellite"]

[Text] Paris—EUTELSAT [European Telecommunications Satellite Organization] has just been given the green light to conclude its negotiations with France's Matra Marconi Space group for construction of its third television satellite, which is to be placed at 13° East, according to an announcement on 30 March by the European Telecommunications Satellite Organization.

The communique points out, however, that if the final negotiations with Matra Marconi Space fail, negotiations may be resumed with the French state-owned Aerospatiale [National Industrial Aerospace Company], which was also a candidate.

The new satellite, initially named Hot Bird Plus, will be delivered 27 months after the contract is signed and will be launched in the summer of 1996. It will join EUTELSAT II F1 in orbit as well as the next Hot Bird, which is scheduled for launching this year. Its expected lifetime is 12 years, EUTELSAT adds.

Television programming services will be able to choose between two coverage zones, one in Europe from west to east—in which case the programs will be accessible with small antennas—and the other from Russia to the Canary Islands and the Gulf countries. This new satellite will operate on both the FSS (11.45-11.7 GHz) and the BSS (11.7-12.5 GHz) frequency band with linear polarization. Its position at 13° East is favorable for direct television, cable, and community antenna reception.

Four EUTELSAT II and three EUTELSAT I satellites are currently active. They carry broadcasting channels

for television, radio, telephony, and communications with businesses and moving vehicles.

The EUTELSAT organization was officially established in 1985 and consists of the public and private telecommunications services of 42 countries.

ESA Manned Space Flight Program Adjustments

94WS0293D Paris AFP SCIENCES in French
31 Mar 94 p 3

[Article: "ESA Reorganizes Manned Flight and Launcher Programs"]

[Text] Paris—The ESA Council at its 112th meeting held 22-23 March approved a reorganization of its manned flight and launcher programs that was ordered on 15 February. Since that time, details of the reorganization were worked out by the agency's director general, Mr. Jean-Marie Luton.

Mr. Jorg Feustel-Buechl will head the manned flight and microgravity programs, and in that capacity he will be responsible for all studies on ESA participation in the international R-Alpha station as well as negotiations with partners in the project, including the Americans, Russians, Canadians, Japanese, and the 14 ESA member countries.

Specifically, he will be responsible for the Columbus laboratory-module program which is to link up with Columbus, related systems (polar platform, etc.), and vehicles for transporting crew and cargo (Crew Transport Vehicle, or CTV, and Automatized Transport Vehicle, ATV), plus the precursor flights scheduled with the Russians between now and the year 2000. He will also oversee all technological aspects of the orbital rendezvous, the future European remote manipulator arm, and the EVA suits that ESA astronauts will wear, as well as operations of the European Astronaut Center at Cologne.

Mr. Fredrick Engstrom as launch director has been given oversight responsibility for the Ariane-5 heavy rocket program, technologies pertaining thereto, future spin-off launcher programs, and co-management (with the National Center for Space Studies) of all ESA utilization of the Guyana Space Center, a spokesman said.

Germany: Instruments for Atmospheric Research Missions Readied

MI1905080394 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
25 Mar 94 pp 22-23

[Text] The German reflyable science satellite Astro-SPAS is currently being fitted out for its next mission at the German Aerospace AG (Munich-based DASA) Satellite Systems Division. The German Space Agency, DARA, and DASA have presented the satellite's new instruments and tasks at a news conference in Munich: The

science satellite, bearing the name Crista-Spas, is scheduled to begin its "inspection" of the upper earth atmosphere in October this year.

Crista-Spas has the job of studying the upper earth atmosphere (10 to 150 km). The photochemical, energetic, and dynamic processes that take place in the upper atmosphere are of great significance to life on earth. An understanding of these processes and the behavior of the atmosphere is central to an understanding of current environmental issues, such as the ozone problem and the much-feared climate problem.

The measurements will be performed with two instruments: Crista and Mahrsi. Crista (cryogenic infrared spectrometer and telescope for the atmosphere) is an infrared measuring device with unprecedented three-dimensional resolution: 2.5 km vertical and 500 by 600 km horizontal.

It was developed to study small-scale dynamic structures in the upper atmosphere that have hitherto eluded measurement by satellite. Small-scale structures in the several hundred to several thousand kilometer range have only been detected to date by rocket, balloon, or ground measurements. However, these only gave local "snapshots," with the result that very little is known of the frequency of small-scale structures in time and space. Crista will make the first-ever global measurement of these structures and attempt to determine their frequency.

The measurements performed by Crista will be complemented by Mahrsi (middle-atmosphere high-resolution spectrograph investigation), a device for measuring radicals in the atmosphere. Mahrsi's main task consists in the global definition of the vertical density profiles of the hydroxyl radical and nitrogen oxide with 2-kilometer resolution at an altitude of 40 to 150 km. The experiment will also provide information as to the neutral density and temperature in the atmosphere.

Responsibility for the development of the experiments, the scientific preparations for the mission, and the analysis of the parameters recorded is shared by the Bergland University in Wuppertal (Crista) and the Naval Research Laboratory, Washington, D.C. (Mahrsi).

The third Astro-Spas mission is scheduled for the fall of 1995 and will be a second flight by the Orfeus and Imaps telescopes, which are being modified and enhanced in the meantime in the light of experience acquired during their first flight. A fourth mission—with the Crista/Mahrsi payload—has been firmly booked for fall 1996.

Germany: More Precise Measurement Possible With PRARE System

94WS0276C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 10 Mar 94 p 8

[Text] Frankfurt (DPA)—The navigational system PRARE (Precise Range and Rate Equipment), which makes it possible to measure the earth with centimeter accuracy, has been introduced at the Geo-Research Center (GFZ) in Potsdam. A German computer is working with PRARE together with a laser situated on board the Russian satellite Meteor 3. Among other things, it can make an exact determination of continental drift, of the "tides" of the earth as a solid body, and of earth's gravitational field. The data is evaluated at the GFZ and also yield the flight path of the satellite with an accuracy of within 10 to 20 centimeters.

It is reported that PRARE has several advantages in comparison to other laser systems: it operates in all weathers, by night as well as by day, with approximately equal accuracy. Data is stored in the satellite and transmitted to the GFZ field office in Oberpfaffenhofen on every pass.

This earth-measuring project is the result of close cooperation between the German and Russian partners. On the German side, participants include the GFZ, the German Agency for Air and Space Affairs (DARA) and Stuttgart University. The satellite was manufactured in Russia by the Research Institute for Electro-Mechanics in Istra (Moscow district), while the flight is monitored by mission control centers in Kaliningrad.

Austria Becomes EUMETSAT Member

94WS0293A Paris AFP SCIENCES in French 24 Mar 94 p 8

[Unattributed article: "Austria 17th Member of EUMETSAT"]

[Text] Paris—Austria has become the 17th member of the European Meteorological Satellite Organization (EUMETSAT), and will be represented by its national meteorological service, the Zentraalanstalt für Meteorologie und Geodynamik.

Austria's membership, says EUMETSAT in a 22 March communique, assures it of access to all data from the Meteosat satellites and offers it new opportunities for international cooperation in its national scientific programs.

Austria, which since 1987 has participated as an observer in meetings of the EUMETSAT council (founded in 1986), has a National Space Studies Center, research institutes, and many companies active in the space domain.

Finland Becomes ESA Member State

94WS0293B Paris AFP SCIENCES in French
24 Mar 94 p 9

[Unattributed article: "Finland New ESA Member State"]

[Text] Paris—Finland formally adhered to the ESA [European Space Agency] on 22 March in Paris, becoming the 14th member state of this institution, with which it has been associated since 1 January 1987.

The adherence accord was signed by the secretary general of the Finnish Ministry of Commerce and Industry, Mr. Matti Vuoria, and ESA's director general, Mr. Jean-Marie Luton. Finland will accede to full-status membership on 1 January 1995, after ratification by its parliament, joining Germany, Austria, Belgium, Denmark, Spain, France, Ireland, Italy, Norway, Netherlands, United Kingdom, Sweden, and Switzerland.

Helsinki, which already has contributed to the scientific program and several optional ESA programs, intends to participate more actively in the agency's space sciences, ground observation, and satellite telecommunications programs.

European Space Research

Decline of Columbus Program

94WS0342A Berlin INGENIEUR DIGEST in German
May 94 pp 18-19

[Article by O. Goering: "Europe's Downfall"; Subhead: "European Aerospace with Back to Wall, Resources Reduced, U.S. and Russia Forming Alliance, Columbus Program Languishing"]

[Text] Space research is currently between a rock and a hard place. In recent years the dimensions and objectives of the ambitious Freedom Project, the space station planned jointly by the U.S., Canada, Europe and Japan, have already undergone repeated moltings. The National Aeronautics and Space Agency [NASA] and aerospace firms fear additional cuts. To play it safe they have assigned a redesign team to look for alternatives in international cooperation as well.

The outlook is not much better in Russia even if one more prestige project for a long-term stay in space has now been launched. In October 1993 there was still not even any more money for a booster rocket to relieve the crew in the MIR station. Another two modules have been standing by for a long while now to be transported into space in order to be added to the space station.

Space research cannot even expect much support any longer from the public. Although the experts do not tire of pointing out to the ordinary consumer the practical advantages of their costly experiments—intercontinental TV transmissions, telephone conversations and data transmissions via satellite or the daily weather maps from space—global recession and political insecurity have caused readiness to finance manned space projects to dwindle.

International Space Station

Bowing to necessity, the U.S. space organization NASA and the Russian space agency RKA have effected a rapprochement, notwithstanding ill feelings. The result is a cooperative agreement that provides for joint construction of space station "Alpha," that will later include the U.S.'s current partner countries.

The Russians are contributing their more than 20 years of experience in the construction of space stations. Especially valuable are their medical know-how about long-term stays in space of up to one year, on-board life-support systems and docking technology.

According to preliminary deliberations the cooperation is supposed to proceed as follows: in the initial phase the Americans will intensively make shared use of the MIR station. Then beginning in 1996/97 a manned station is supposed to be developed from the core module of MIR-2 and the U.S.'s laboratory module. In the third phase this will be fashioned into an international station and include Canada, Japan and the European Space Agency [ESA] also.

But there are reservations. Although the concept may be politically and financially convincing, the Europeans, above all, fear that they will be sidelined by the warm embrace of the two space giants.

Currently under Germany's overall leadership within the ESA's Columbus program a module has been developed that is supposed to be coupled to the space station as a work and living area for the astronauts. This "Attached Pressurized Module" [APM] reportedly has a length of 12.8 meters, a four-meter diameter and weighs as much as 28 tons.

What the U.S. and Russia are now jointly contriving renders that project obsolete. A higher orbital inclination vis-a-vis the equator at 51.6° is to be selected for the international station. That suits the Russians, since their present space stations already occupy that orbit from the Tyuratam launch site in Kazakhstan. Freedom, on the other hand, is to have a 28.5 degree orbital inclination. This consequently facilitates the maximum space shuttle payload from the launch site at Cape Canaveral.

After launching there can hardly be justification for any alteration of the specific orbital inclination for the Russians. It would require additional energy and the effective weight of the U.S. booster systems would be reduced.

The new variations have heavily impacted the ESA and Japan. Their modules have been designed for the shuttle's maximum payload. The reduction that is now required will result in higher costs for Europe and narrow their scientific programs. The Europeans cannot even prevail by arguing that the crew reduction takes away necessary working space. The Russians, on the other hand, maintain that with the MIR-2 core module and possible additional modules there will be sufficient room available at least for the first year of operation.

Under budgetary pressure in Germany, Jan-Baldern Mennicken, the general director of the German Space Agency [DARA], has asserted that development of the

Columbus module should no longer be pursued. It would make better sense to introduce key systems as early as the second phase of the construction beginning in 1997. "There are good prospects here for the data management system developed for the Columbus and that the Russians want to incorporate into MIR-2."

As always, thousands of well paying jobs in Germany are at risk. At stake is valuable know-how that has been accumulated over many years and that later will possibly have to be repurchased at high cost from abroad.

Europe and Japan have to swallow yet another bitter pill. The launch deadlines are being moved from 1998/99 to the year 2002, or even later. Each year of delay results in additional costs of several dozen millions.

The free-flying laboratory originally planned by the ESA in the Columbus program, that was to be transported into orbit with the Ariane 5 and serviced by the Hermes space transporter, has now been virtually brushed aside. Since the decision was made not to build the Hermes there is just no way of determining how it can be introduced in other projects.

The question is wide open as to what alternatives for cooperation are left for Europe with the super-union of the U.S. and Russia. It is hardly possible any longer to speak of a partnership. The ESA is still seeking to paper over the breach: there is agreement on the fact "that a process of ongoing consultations has to be implemented on all levels that could lead to Russia becoming an equal partner in the international space station," is the way it is diplomatically worded from Paris.

The ESA has been forced to tackle the issue head on. But its proposal to contribute a manned transport capsule and a freighter has hardly met with a warm reception. Yuri Semyonov, general director of NPO [Scientific Production Association] Energiya, snidely retorted: "Why reinvent the bicycle? Both systems are already available in Soyuz and Progress."

German Participation in SSTO Vehicle

94WS0342B Berlin *INGENIEUR DIGEST* in German May 94 p 19

[Article by LUK: "Small Leap, Great Hope"]

[Text] The 12.6-meter tall model rocket took off, climbed up to 90 meters, shifted sideways 105 meters, and 66 seconds later made a soft landing in an upright position. The manufacturer, McDonnell Douglas, was enthusiastic: the principle of a single-stage, fully reusable booster system had proven its practicability. The first flight into the stratosphere of the Delta Clipper-Experimental [DC-X] is supposed to follow with two years. If all goes well, commercially usable rockets measuring 39 meters in height and having an 11.5-ton payload could then be developed.

The idea of a "single-stage-to-orbit vehicle" [SSTO] reaches back to the sixties. Douglas Aircraft's Phil Bono wanted to build a rocket that could dispatch U.S. troops

to crisis areas around the world in an hour. At the time there were no prospects for the project. NASA had its hands full with the space shuttle.

Only after it became fully evident that over the long run the principle of lavish space travel was too costly did people in the U.S. space sector recall the SSTO that had been shelved. Max Hunter, one of McDonnell Douglas' leading design engineers in Huntington Beach (California), also saw in it an opportunity to recoup at least something from the loss of contracts concomitant upon the cessation of the Space Defense Initiative [SDI] program. Other lobbyists kept pressuring until then U.S. vice-president Dan Quayle diverted \$80 million from the SDI program to McDonnell Douglas' SSTO project in 1991.

In the words of project director William Gaubitz: "The aim in developing the Delta Clipper is a space-travel system that can fly both with and without a human crew, does not eject any part in flight, lands upright and is fully reusable." Average cost of a "Space Shuttle Light" launch will supposedly cost \$10 million. NASA currently projects \$409 million for each launch of a space shot.

It takes only 18 months to build the DC-X. In the period following the first trial flight in August 1993 at the U.S. White Sands test site in New Mexico additional launches entailing flights as high as several hundred meters have been carried out.

German engineers have likewise contributed to the current success. The landing system with each of its 160 kilogram [kg] light-weight telescoping legs and landing feet was developed and built in the record time of nine months at Deutsche Aerospace AG [DASA] in Munich. It also entailed the largest subcontract that U.S. aerospace firms have awarded so far outside the U.S. for the Ottobrunner design engineering firm.

France, Israel Space Agencies Sign Accord

94WS0331A AFP SCIENCES in French 14 Apr 94 p 5

[Text] Paris—The National Center for Space Studies (CNES) and the Israeli Space Agency (ISA) signed a three-year, tacitly renewable collaboration agreement on 11 April in Tel-Aviv. The accord was signed by the general director of the French space agency, Jean-Daniel Levi, and his ISA counterpart Marcel Klajn. It had been discussed during the visit of French foreign affairs minister, Alain Juppe, to Israel in February.

Israel and France have already collaborated in the past, since the Amos satellite was built by Israeli Aeronautics Industries, Alcatel (France), and Dornier (Germany). It is slated to be launched next year by an Ariane rocket.

The two agencies will work together "to use space for peaceful ends and for economic and scientific development," in accordance with the terms of this "arrangement defining a framework for collaboration in space."

The accord should also stimulate joint space projects between the two countries and their industries. It will cover space research in the fields of astronomy, solar system exploration, Earth sciences, biology, space medicine, and microgravity physics.

It will also involve applications in Earth and environmental observation, weather forecasting, systems for collecting and localizing environmental data, communications, and the positioning of satellites. The two agencies will work together on space techniques relative to robotics, small satellites, space technology, and quality-reliability problems. A mixed committee bolstered by expert working groups will coordinate their work.

Germany, Netherlands Cooperate on ENVISAT Instrument

MI0605153994 Duesseldorf HANDELSBLATT in German 30 Mar 94 p 16

[Text] The Federal Research Ministry is granting a total of 150 million German marks [DM] in subsidies towards the construction of the "Sciamachy" (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) remote sensing instrument, DM50 million of which will be to process the data for use. At the same time, the Netherlands are providing about 75 million guilders [hfl].

A cooperation agreement to this effect was signed yesterday by the German Space Agency (DARA) Managing Director Jan Baldem Mennicken and the Dutch Aircraft Development and Aerospace Institute (NIVR) Chairman von Ardenne. The bilateral project will be a major step in the joint efforts to make greater use of aerospace technology in international cooperation for environmental research, State Secretary of Federal Research and Technology Ministry Gebhard Ziller stated.

It also increased the joint commitment of both nations to satellite-based Earth observation. German-Dutch cooperation in developing Sciamachy was an outstanding example of European cooperation on a space program, Ziller said.

Sciamachy will measure traces of gases, of great importance particularly for ozone depletion and the greenhouse effect in the atmosphere. Developed by German and Dutch scientists and firms since 1989, the Sciamachy absorption spectrometer will be used in the European Space Agency (ESA)'s "ENVISAT-1" mission planned for 1998. The ENVISAT-1 environmental satellite's complex payload is designed to observe the atmosphere, the oceans, land surface, and the polar ice caps.

ENVISAT is being developed by a European consortium headed by a German firm. The ENVISAT mission is part of the international "Mission to Planet Earth" initiative and will give Europe a fresh opportunity to consolidate its technological lead in Earth exploration, DARA

reports. Two instruments developed in Germany for observing the Earth's atmosphere have already been installed on it.

Germany-Japan-Russia: Spaceflight Cooperation

94P60254A Berlin INGENIEUR DIGEST in German May 94 p 8

[Text] German researchers are presently arranging a Russian-German-Japanese Space cooperation project. They are outfitting a Russian reentry vehicle with German infrastructure for the "Express" experiment.

There will be German and Japanese experiments on board the capsule, which will be launched on 9 September by a Japanese M2-S3 booster.

The Munich Kayser-Threde GmbH is responsible for the central power system for the equipment, the boosting and processing of the measurement signals, and data processing.

The three experiments will concentrate on the continued development of technologies for reentry into the Earth's atmosphere. The scientific work will begin at the conclusion of the flight, when the nose cone of the capsule heats up to 2,400°C in the atmosphere. The capsule will be brought to Japan in July to prepare for launch.

ESA To Test Satellite Data Transmission By Laser

BR2104134994 Amsterdam POLYTECHNISCH WEEKBLAD in Dutch 18 Feb 94 p 1

[Article by Rene Raaijmakers: "Advance of Communication Lasers in Space Industry. No Need for Radio Frequencies in Future Satellites"]

[Text] Noordwijk—In 1997, for the first time in history, two satellites will transmit using light. It will only be a test, but data transfer using infrared lasers instead of radio waves ultimately promises great advantages.

In an artist's impression or on a photograph of a hovering man-made moon, two significant components are instantly noticeable: the solar panels and the dish antenna. Such a view could drastically change if satellites start using optics for communication. The dish would disappear altogether and the solar panels would become smaller. Volume and weight savings are within reach, and those are powerful criteria in competitive space exploration. The European Space Agency (ESA) will therefore start experimenting with lasers and optical receivers within the next three years.

Optical Data Transfer

ESA is taking the first step with the launching of the French earth observation satellite, Spot-4, at the end of 1996. Shortly after that, at the beginning of 1997, Artemis will be launched into space. Artemis is an advanced geostationary satellite by which various new

telecommunications systems will be tested. These two will be the first to make use of optical data transfer. In addition to the usual dish antennas, with a diameter of almost three meters, each satellite will be specially equipped with a telescope 25 centimeters in diameter.

An optical receiver with this diameter would at the moment be no lighter than the dish antennas. But when lasers with a higher capacity are used in the future, the mass of the optical modules could well decrease. "There are as yet no advantages with these first attempts. But by the second or third generation we make a profit," said Gotthard Oppenhauser, payload manager Data Relay Technology Mission (DRTM) at ESTEC in Noordwijk. Spot-4 will send remote sensing data back to the earth via Artemis. The Spot observation satellite orbits at a high speed only 700 to 800 kilometers above the earth's surface and can as a result remain in contact with an individual ground station for no longer than 10 minutes. The Silex optical modules on board Artemis and Spot-4 will, however, enable a direct connection between the observation satellite and the control room in Toulouse (France). Contact is possible as long as Spot-4 is within view of Artemis, which will hover 36,000 kilometers above the earth. Every 50 minutes, Spot will disappear behind the earth's sphere and will in practice be in direct contact with Artemis for only about half of its orbit.

Greatest Challenge

This also means that the satellites will continually have to search for each other. They will send out strong signals with 19 high capacity lasers, each of 500 milliwatt. This "searchlight" cannot be relied upon for communication, but only for identification. For the actual transmission, a 100-milliwatt semiconductor laser will be installed. Both kinds are (aluminum gallium arsenide) semiconductor lasers with a wave length of about 800 nanometers. This wave length was chosen because it is suitable for the most sensitive receivers. There will be two reserve 100-milliwatt lasers on board.

The greatest challenge in the ESA project is the development of a very accurate tracking system. For communication purposes, a continuous connection is necessary between the stationary Artemis and the Spot-4, which will be moving at a speed of 30,000 kilometers an hour. The Silex modules on board Artemis and Spot-4 must be able to track each other at an accuracy level of 0.50 millidegrees. This means that at a distance of 36,000 kilometers, a deviation of a maximum of 100 meters would be allowed. Sensors and electronics must constantly read, calculate, and correct the deviation. The laser signals from Artemis will also be received at an optical ground station on Tenerife. At an altitude of 2,500 meters, and thus almost free of diffused light, a telescope one meter across will be erected during the second half of 1995. The optical antenna has already been made by Carl Zeiss Jena, with support from the German space institute DARA, and was completed in November 1993. At the moment it is undergoing extensive testing.

A Promising Future

The Silex terminals of which the lasers will form a part were developed by ESA in collaboration with the French space laboratory CNES [National Center for Space Studies]. The transmission speed is 50 megabits per second. With these optical modules, communication is also possible in principle over a distance of 40,000 kilometers at a speed of 100 megabits per second, but the electronics on the Spot-4 are still a limiting factor. Radio waves for satellite communications (with a wave length of 15 and one centimeters) generally also reach a transmission speed of 100 megabits per second.

In principle, however, lasers can be modulated with a much higher data speed. For satellite applications, however, a higher capacity is also necessary. "We are doing it with a simple but robust method," said Oppenhauser. "We are merely switching the lasers on and off 50 million times a second."

In the future the question to consider will be: greater data speed with more capacity, or a smaller telescope. In any case, Oppenhauser expects a ten-fold improvement in the sensitivity of the optical detection by use of more sensitive modulation methods very soon.

Not much energy is required for the laser transmission. The present lasers work at 100 milliwatt, while satellites for radio transmission need to be able to produce 30 Watt very quickly. It will therefore be possible to have smaller solar panels in the future.

A consortium of some 20 companies under the leadership of Matra Marconi Space will handle the production of the Silex terminals. The first commercial optical modules will be installed on the DRS1 and DRS2 (data relay satellites) which will probably be launched in 1998 and 2003 respectively.

Netherlands, Germany Cooperate To Construct 'Sciamachy'

BR2104134894 Zoetermeer WETENSCHAPSBELEID
in Dutch 1 Mar 94 pp 3-4

[Article by Josee Piepe: "Why The World Needs 'Sciamachy'"]

[Excerpt] [passage omitted] Up to now, our knowledge of the composition and chemistry of the atmosphere has remained very incomplete. That is the reason why, in 1989, a start was made on the so-called Sciamachy project. Sciamachy stands for "Scanning Imaging Absorption Spectrometer for Atmospheric Cartography." The project includes the development and construction of an instrument which can measure very precisely the ozone and other trace gases in the atmosphere. If everything goes according to plan, the Sciamachy instrument will be placed on ESA's (European Space Agency) ENVISAT-1 satellite. The satellite, equipped with Sciamachy, must be launched in 1998.

Satellites

Satellites play an essential role in research into the atmosphere. Measurements carried out in space are very attractive because they make it possible to study the atmosphere at random places above the surface of the earth. Moreover, space platforms provide the possibility to carry out simultaneous measurements with instruments that complement each other. Results obtained via these measurements can then be compared more easily with each other, and the findings are more reliable. Because even the smallest trace particles influence the atmosphere, researchers need to demand high standards for the measuring sensitivity of their instruments.

Advantages

The problem, for instance, with measuring the local ozone layer is that local concentrations of ozone not only undergo many daily changes but also seasonal changes. The concentration also varies according to the latitude. The determination of annual trends therefore requires both long-term and accurate measurement, which is where the great advantages of using Sciamachy come into play. Sciamachy can perform continuous measurements for many years. In addition, a particular point is that this instrument can carry out measurements of unprecedented exactitude. Sciamachy will be able to measure the precise composition of the atmosphere to a very high degree of accuracy, both vertically (looking down perpendicularly) and horizontally (looking along the atmosphere). Expectations are high: observations carried out with Sciamachy will play a very important role in the understanding of the chemical composition of the atmosphere and of its eventual changes.

Together

Observation of the earth is very costly. The Sciamachy project is a joint project between the Netherlands and Germany and costs some 170 million Dutch guilders [G]. The Netherlands' share of this is G75 million. In constructing this instrument, Germany and the Netherlands are in fact contributing in kind to the ESA [European Space Agency] earth observation program. The Ministry of Education and Science is paying G34 million, that of Economic Affairs G22 million, while the Ministry of Housing, Planning and Environment is paying G19 million. It is the first time that the last-mentioned ministry has been involved in a large earth observation project, because environmental and climate research will both benefit from Sciamachy. Netherlands management for the project rests with the Netherlands Institute for Aircraft Development and Space Travel (NIVR), while their German counterpart is DARA (the German Agency for Space Exploration Matters). At the end of March 1994 the two countries will sign a memorandum of understanding, to emphasize once again their positive collaboration on the project.

AUTOMOTIVE INDUSTRY

Germany: Rapeseed Oil Used To Propel Taxis in Freiburg

94WS01289B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 15 Mar 93 p 8

[Article: "Rapeseed Oil Test in Freiburg Successful"]

[Text] Frankfurt—In Freiburg a field test with 29 taxi drivers, who for two years operated their diesel taxis exclusively with rapeseed oil and drove a total of about 2.5 million kilometers, has been successfully concluded. Model 190 D and E Mercedes-Benz vehicles were used and about 240,000 liters of non-estered rapeseed oil (RME).

As reported by Mercedes-Benz AG, just a few technical problems occurred during the test. The test results are so promising that the test series will continue with two modified C-200 diesel taxis this year in Stuttgart.

The RME fuel was supplied by Novamont (Montedison-Ferruzzi Group). It is comparable to diesel, but is non-toxic and biologically degradable. When it is growing rapeseed absorbs about as much carbon dioxide as is released when burning it. According to information by the Federal Environment Office, the absolute carbon dioxide emission is about 35 percent below that of a diesel-operated passenger car.

The Freiburg taxis equipped with exhaust gas recirculation and oxidation catalysts only needed a small amount of technical alteration, it is further said. This applied to the replacement of elastomer hoses and seals in the fuel supply with parts made of special rubber. Dealing with the fuel itself, however, required a great deal of attention. Rapeseed oil turned out to have a tendency to become contaminated, which occasionally led to clogged injection nozzles.

But such fuels are unsuitable for widespread use. In order for all diesel cars in the old laender to be able to drive on RME, 56 percent of the German agricultural area would have to be planted in oil plants. However, it is worth considering application in consumer niches, argues Mercedes-Benz.

Germany: Daimler-Benz Experiments With Hydrogen-Fueled Hybrid Car

94WS0332B Paris AFP SCIENCES in French 21 Apr 94 p 40

[Text] Ulm—On 13 April the German automaker Daimler-Benz experimented with a hydrogen-fueled car at its Ulm research center. According to the group's CEO, Edzard Reuter, the vehicle marks "a first step toward 'ecological mobility.'"

The vehicle's electric engine is not fueled by batteries, but by its own small electrical plant that runs on hydrogen. The hydrogen converts solely into water

vapor, which is expelled into the air. Reuter considers the advance significant not only for the automobile industry, but for energy supply in general. Daimler could play an important role in the market for new energies in the future through its knowledge of the new technique.

But Hartmut Weule of Daimler's research department stressed that it will take engineers and researchers years of continued testing before the revolutionary model can be mass-manufactured. Daimler group has already invested over 100 million German marks in hydrogen vehicle research.

Automated Charging Station to Boost Electric Vehicles

94WS0313A Duesseldorf VDI NACHRICHTEN
in German No 14, 8 Apr 94 p 22

[Article by Rolf Helmueller: "Electric Drives for Local Public Transportation Vehicles—Automatic Single Push-Button Battery Exchange—Automated Charging Stations to Allow Scheduled Service by Battery-Driven Busses"]

[Text] Automated battery exchange stations make it possible to use battery-operated busses for scheduled service. Electric busses can be used for scheduled service only if these exchange stations are designed so that they require no physical strength and a bus driver can use them without difficulty. Bob Lee, technical director of "Neoplan" Gottlob Auwaerter GmbH, Stuttgart, is convinced that this is possible. At the conference, "Electric Drives for Local Public Transportation Vehicles" in Aachen on 24 March, he stated that this system provides the technology for 24-hour service.

He also stated that the mobility of the battery-charging stations which "Neoplan" developed together with battery manufacturer Varta is the key for scheduled bus service using electric busses. The charging station can be placed at any location and require only a few square meters of space. Due to their container format they can be relocated by any truck suitable for container transport. Bob Lee explained at the VDE conference in Aachen. This makes it possible to use this lead traction battery with armor-plate technology and electrolytic conversion wherever it is needed. According to the vehicle manufacturer's managing director even a change in the bus route layout would not be a problem. The limited range of scheduled busses, as well as the recharging time of 5 to 6 hours, would not be a factor with the new mobile system.

A typical scheduled service cycle, for instance, covers approximately 140 km per 10-hour day. According to Bob Lee, no currently available standard battery is able to provide the necessary power without a recharging time of several hours. Even quick and partial charging methods require downtimes which are not acceptable for scheduled bus service.

With the battery exchange system presented the bus will drive approximately 40 km—approximately seven trips on a 5-km long route—and then stop at an exchange station positioned along the route. Two roller band arms from the station will be attached to the bus. When the driver pushes a button, the empty battery is taken up by the roller bands and moved from the bus to an empty charging bay in the exchange station. When another button is pushed a charged battery is transported into the bus. "This does not take longer than a stop at a gas station", states Dr. Rainer Bittihn, head of systems development in the Varta industrial batteries division, Kelkheim. He explained that this is the reason why the complete system consisting of bus battery and exchange system has met with broad acceptance among operators and bus drivers during many actual demonstrations.

In its standard version the battery exchange container with a footprint of 2.5 x 6.0 m can accept up to four batteries which will be charged simultaneously. Two two-level shelves and a lifting table on a loading area are provided. A separate room houses a corresponding number of chargers and the water supply for the "Varta-Aquamatiksystem." As an example, five batteries are required to ensure uninterrupted service of two busses from 6:00 a.m. to 10:00 p.m.

According to Rainer Bittihn this concept can also be used for the local distribution of goods. Smaller, battery-driven trucks would accept the goods from heavy trucks or trains at centers close to downtown and distribute them throughout the city. The centers could also be used as exchange stations. According to battery expert Bittihn, the prerequisites for such a system are already present; to put it into practice requires "nothing but the commitment and decision by politicians".

Germany: Electric Auto Tests on Ruegen Continue

94WS0329C Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 3 May 94 p T4

[Article by Martina Lanzrath: "Batteries Are the Achilles Heel of Electric Cars"]

[Text] In the seclusion of the Baltic island of Ruegen, the softly humming electric car prototypes are making their first test runs. Yet the vagaries of battery technology, above everything else, delayed the still uncertain steps of the newly constructed E-car and dragged the bearer of hopes for doing away with exhaust fumes through the turmoil of [newspaper] headlines. The familiar words "Ruegen [(or "reprimands" in English)] on Ruegen" made the rounds, and a cool breeze of skepticism hit the [producers and drivers of non-polluting cars]. A little annoyed and looking suitably injured, the Ministry of Research and Technology along with representatives from the automobile industry, battery producers and electric companies are now doing an interim evaluation of the field tests on Germany's largest island. Difficulties with the high-performance batteries and their integration into the current concept of the [electric car] were in

fact, as Research Minister Paul Krueger conceded, more serious than was at first suspected. In the meantime, however, the 36 electric cars carried out their humming work quite reliably and all together already have around 185,000 km of local exhaust-free [driving] behind them. The electric fleet is supposed to be increased to 60 vehicles by August, all outfitted with automatic measurement units which until 1996 will provide a unique data bank.

The Ruegen cars get energy from four different storage media. In addition to the older lead-gel battery, the sodium-sulphur, the nickel-cadmium and the sodium-nickel chloride batteries are also being put to the test of everyday use. Since freedom of travel is still limited for the electric cars, one pilot fuel station in Zirkow is currently testing a quick-charge technique. This would make it possible to "tank up" the batteries in less than a hour. Minister Krueger and the industry are promising [travel] distances of a full 400 km only from the third generation of propulsion batteries based on lithium, whose development is still in its infancy. The Research Minister remains decisively loyal to the local emission-free clean driver, even for the future. In addition to the major test being supported on Ruegen with 22 million German marks, 60 million more will be made available for the development of fuel cells. This technique electrochemically transforms combustible liquids or gases directly into electricity—and practically without producing any pollution. Even with the market introduction of economical, mass produced vehicles, the federal government will stand beside the car makers. An inter-ministerial working group made up of representatives from the ministries of Transportation, the Environment, Financial Affairs and Research as well as the office of the Chancellor have since the end of March been preparing appropriate guidelines.

For Volkswagen Director Ulrich Seiffert, exemption from the automotive tax, harmonizing the competitive conditions and tax advantages are basic requirements for giving the electric cars any chance at all on the automobile market. At the same time, the German industry's technical lead may not be thoughtlessly gambled away to thus leave the way open for the Japanese producers. "There is a danger that we are becoming a country hostile to innovation." With these words the industry representatives demonstrated—with a side glance at the Ruegen critics—the auto makers' new sensitivity to things concerning the electric car.

Germany: Daimler-Benz Prototype Electric Car Runs on Fuel Cell

*M11905075594 Duesseldorf HANDELSBLATT
in German 14 Apr 94 p 24*

[Text] Daimler-Benz is looking for an alternative form of energy for the automobile. At its research center in Ulm, the company yesterday presented a vehicle with an electric motor which gets its energy from a fuel cell

Speaking at the company's research center in Ulm, the Chairman, Edzard Reuter, stated that Daimler-Benz AG was well in front of the international field with the car driven by a fuel cell instead of a petrol or diesel engine. The prototype vehicle has already done 2,000 km without any problems. The task now is to reduce the size and weight of the fuel cell by using new materials and technology, and to develop the system at a marketable price. Research Chief, Prof. Hartmut Weule, is confident that this can be done within a period of 20 to 30 years.

In addition, Daimler-Benz is continuing the development of electric vehicles with the Zebra battery, a high-performance battery with sodium and nickel chloride. This is one of several possible solutions developed by the Daimler subsidiary AEG.

Daimler-Benz runs the fuel cell with methanol from which the hydrogen is obtained in the vehicle. Methanol is produced from natural gas and is a widely available chemical substance. A vehicle could fill up in the normal way from a pump at service stations. The vehicle's range with one tankful matches that of today's vehicles. The advantage of the fuel cell is the greater efficiency of 30 percent compared with 17 to 20 percent of conventional car engines.

Hydrogen is generated in the automobile by means of an ion-permeable-polymer electrolyte membrane. The car travels with virtually no harmful exhaust gases, since no nitrogen oxide is produced during cold combustion. The only exhaust gas is water vapor. Consequently, the car already complies with the Californian zero emission requirement. Moreover, only half the amount of carbon monoxide is produced. This alternative form of power is a joint achievement of Dasa and AEG, who developed the project jointly with Daimler's automotive engineering division. Daimler is cooperating with the Canadian company Ballard Power Systems on the development of fuel cells. According to Reuter, "We have gained an important lead with synergistic effects within the company and in international cooperation." Daimler has invested hundreds of millions so far. The technology costs 15,000 German marks per kilowatt of output.

Weule thinks there will be numerous potential applications for the fuel cell in the future. It could power railways and ships, provide satellites with electricity, or provide hospitals with an emergency power supply.

At present, there are five competing technologies:

- Proton-conducting fuel cells operate at [a temperature ranging] between 20° and 100°C, and require hydrogen, which Daimler obtains from methanol;
- Alkaline fuel cells have the greatest efficiency but require pure hydrogen and oxygen;
- Phosphoric acid fuel cells operate with phosphoric acid at 200°C and are suitable as decentralized combined heat and power plants;

—Fused carbonate fuel cells requiring temperatures of 650°C, are also suitable for coal gas and are likely to come on the market in a few years' time;

—Solid oxide fuel cells are particularly efficient at 1,000°C but the high temperatures cause problems.

Daimler-Benz is going for the proton-conducting system. The present unit still weighs 800 kg and fills the cargo space of a delivery van. There will be a second version by 1996 which, at one eighth of the size and weighing only 200 kg, will also fit into a passenger car.

How Fuel Cells Work

Fuel cells convert combustible liquids or gases directly to electricity by electrochemical means with a relatively high efficiency of up to 60 percent. The reaction takes place via hydrogen and oxygen to water. The fuel cell is made of an anode and cathode which are separated by an electron-impermeable electrolyte or a membrane. Pure hydrogen or a hydrogen-containing gas is passed to the anode where the hydrogen molecules are split into ions, and electrons are liberated. These flow via an external conductor to the cathode. At the same time, oxygen from the air is supplied to the cathode. The oxygen takes up electrons and the oxygen ions combine with the hydrogen ions to form water.

The hydrogen in the technology presented in Ulm is separated from methyl alcohol. The fuel cells operate silently and without vibrations, and do not develop any environmental pollutants. Various types of fuel cells are being developed all over the world, and some are now undergoing practical tests. Buses powered by phosphoric acid fuel cells are already operational in Vancouver (Canada). Fuel cells do not only provide power for electric cars, however: If designed on a larger scale, they provide an alternative to conventional power stations. Due to their compact, modular design, their output ranges from 50 kW to several megawatts.

BIOTECHNOLOGY

Germany: Genetic Engineering R&D Funds To Be Increased

MI1905075794 Duesseldorf *HANDELSBLATT*
in German 13 Apr 94 p 6

[Text] According to Federal Research Minister Paul Krueger (CDU) [Christian Democratic Union], speaking in Bonn on Tuesday, the federal government intends to increase the funding for genetic engineering research and to turn research results more rapidly into practice.

Krueger said there are already signs that important competitive positions of industrial companies could also change over the next few years due to the results of genetic engineering research. To ensure that Germany's advantages achieved in basic research are now turned into products and applications, Bonn intends to extend its funding.

As an important step in this direction, Krueger cited the new funding project, "Techniques for Deciphering and Using Biological Structures," which will put genome research on an efficient methodological basis. The Federal government intends to provide 100 million German marks for this research program over the next five years. The program, which takes an interdisciplinary approach, will intensify biomedical research and help to fight to date incurable diseases.

When presenting the new program, Krueger called for the public to pay more attention to the "important and sensitive area" of genetic engineering and genome research. It was definitely unfortunate for the Federal Republic that, for example, authorization procedures for the application of research results in this field took six to eight years, but only a few months in the U.S. This discrepancy should be removed.

For the Research Minister, genome research sets the basis for progress in bioengineering and medicine. In spite of all the ground yet to be made up, genome research has also developed in Germany over the past five years to become an innovative core area of modern biology. At the center lay questions of deciphering and using the biological structures present in molecular form as genetic information in cells. With the aid of genome research it would be possible to put medicine, industry (particularly the pharmaceutical industry) and agriculture on a "new scientific and technological basis."

The Research Minister made it clear that further development of genome research in Germany would be accompanied by legal framework conditions. One area requiring particular protection is that of data on the genetic structure of individuals. Legal regulations guaranteeing effective data protection and preventing any misuse are of prime importance. There would be no "see-through man," a concern often warned against in this respect. Appropriate government bills to amend the Code of Criminal Procedure or the skeleton law on employment protection have already been prepared.

Experts at the German Internists' Congress have spoken in favor of increasing the use of genetic engineering in medicine. The cancer specialist, Volker Diehl, from Cologne stated in Wiesbaden on Tuesday that numerous promising treatments involving genetic engineering methods were about to be tested in clinical tests. Genetic engineering therapy was often the last possibility for helping incurably ill patients.

Medicine had a "missionary zeal" to advance, said Diehl. However, science had made an error in not having made the goals of genetic engineering sufficiently clear to the public at large. The sole aim was to treat diseases with genetically improved substances or cells. Dr. Hermann Heimpel from Ulm said that genetic manipulations on human genetic material were prohibited throughout the world and were taboo amongst scientists, although it remained to be seen whether this consensus would still exist in 20 years' time.

Germany: Biological Remediation of Military Areas

MI2204083894 Munich SUEDEUTSCHE ZEITUNG
in German 10 Mar 94 p 35

[Article by Nicola Siegmund-Schultze: "Microbes Eat Up Explosive Materials—Scientists Test Methods of Biological Soil Remediation on Military Site"]

[Text] "Zuendhuetle," meaning ignition cap, is the name of a residential area in Karlsruhe, and not without reason: Percussion caps, detonator caps and munitions for civilian weapons were manufactured here right up to the seventies. New apartments were built on parts of the factory site in the eighties. Today, the citizens there are wondering whether they may have built on poisoned land. Although the competent authorities knew what the site was formerly used for, they did not remove potential risks due to pollutant residues before allowing the land to be built on. Not until the beginning of the nineties did they start a systematic investigation.

The "Zuendhuetle" is only one of many examples of how slowly the awareness of the dangers of military legacies develops. "In the old German laender, people started to make a record of weapons waste at the beginning of the eighties; in the new laender they did not start until the reunification," stated Manfred Kurka from the Federal Environment Office in Berlin recently at a symposium on "Military wastes" in Offenbach. By the summer of last year, the authority had identified more than 4,000 "suspect sites" of weapons wastes and informed the German laender accordingly.

There are still no uniform criteria throughout the laender for assessing pollution with weapon-specific hazardous substances. Not even the term "weapons waste" has been defined consistently throughout the laender. The development of techniques for cleaning up these legacies in an environmentally acceptable manner is likewise in its infancy.

Explosives are a particular problem. Trinitro- and dinitrotoluene (TNT, DNT) are frequently used. DNT is extremely harmful to the blood, and can cause cancer in the long term, as can the degradation products of TNT. Whenever these substances occurred in their pure form, as in munitions residues on former training grounds, they were often burnt in the open air, resulting in contaminated soil and ground water. According to Kruka, the only environmentally acceptable way of incinerating the material is currently being tested by Buck in Pinnow near Berlin.

The situation is even more complicated when the substances have contaminated the soil, as in Hallschlag near Daun in the Eifel, where explosives were once manufactured. Right up to 1987, cows were still grazing on the former works site. It is now known that about 80,000 cubic meters of soil are contaminated. In many places beneath the grass, the nitrotoluenes reach such high concentrations that there could be explosions if drilling

were carried out for testing or remediation purposes. Pure explosive is to be found there in some places.

Microbes could be extraordinarily helpful in dealing with the explosive inheritance. Certain types of bacteria of the pseudomonas strain, and also azotobacteriaceen, both natural soil dwellers, can thrive on TNT and DNT as a source of carbon and nitrogen. They degrade the explosive and convert it to composites from which they obtain energy or synthesize vital molecules. Toxic degradation products (metabolites) may, however, also be produced.

Attack by Bacteria

Andre Dahn, an engineer at Berlin-Consult GmbH, and Peter Koehler from the analytical center of Forgenta in Berlin, presented a process at the congress with which even highly contaminated soils can probably be decontaminated by chemical and biological means in the future. Initially, they render the toluene water-soluble by treating the material with chemicals, namely a strong base, and heating it. As a result, the dangerous substances are altered to such an extent that bacterial degradation is possible, from which no toxic substances are expected. The cooled solution is ready for attack by bacteria.

Mixed bacteria populations are used—including the explosives consumers—which survive partly with and partly without oxygen (aerobic and anaerobic). It is useful to use such mixed populations because they often form stable communities and require only few additional nutrients. After the anaerobic reaction phase which precedes the aerobic phase, the researchers noticed during the experiment that just under 70 percent of the pollutants had already been decomposed. As yet, however, there are no test results for the biological process as a whole. The Federal Environment Office considers the process to be promising. It is currently being optimized with a view to being used in Hallschlag.

A research group from Braunschweig Technical College is also considering micro-organisms for environmentally acceptable toxic waste remediation. At the Institute for Microbiology, Martin Wittmaier is working with colleagues on the question of how organic, aromatic hydrocarbons—benzene, xylene, or toluene—but also highly chlorinated composites and mineral oils can be disposed of biologically in situ.

Substances like these can occur and pollute soils and ground water wherever vehicles and machines are maintained and repaired, for example, on troop exercise sites. The Braunschweig-based scientists want to exploit the natural self-cleaning potential of the soil. To this end, efforts are being made to promote the growth of those microorganisms that are capable of decomposing pollutants in the earth but for which the earth does not provide the ideal conditions for propagation.

Their metabolism is specifically activated, for example, by introducing certain nutrients or gases by means of pipes (wells) inserted vertically in the soil. The microbes

then multiply and destroy the substances to be removed. In this way, high rates of decontamination have been achieved in experiments. A plant installed on the site with which the area of a solvent recycling company was cleaned up achieved pollutant degradation levels of more than 99 percent. Such remediation measures do, however, take time. Depending on the degree of contamination, the process may take months or years.

The ecological damage by toxic military waste will be a matter of increasing concern for the government and laender in the years to come. The troops of the former Soviet Union are leaving behind "massive environmental damage" on their 1,026 sites, according to initial research by Christina Sussbauer from the Free University of Berlin. She criticizes mainly the agreement to offset the value of the buildings and land against the environmental damage. As there is no financial inducement to hand over land "in a clean state," harmful substances and munitions were just left. Disorderly scrap heaps were created and drums with oil and other pollutants were simply thrown away—adding daily to the new toxic waste.

France: Human Genes Implanted in Animals

94WS0273B Paris AFP SCIENCES in French
3 Feb 94 p 27

[Unattributed article: "Mutant Rabbits in the Year 2000, the Future of Human Medicine"]

[Text] Paris—Thanks to new animal-genetics techniques, researchers are about to manufacture mutant rabbits and pigs capable of producing molecules that will cure human diseases, or whose organs can be transplanted in man.

The key to this research is transgenesis, a leading-edge technique used by INRA [National Institute for Agronomic Research] researchers for some 12 years to transfer genes from one species to another. One of the principal objectives of gene transfer is to cause mutant animals to produce some valuable molecules that will cure human diseases such as AIDS, arteriosclerosis, or the lack of red blood cells, or to be able to transplant animal organs in man.

Thus, in recent months the INRA researchers have managed to implant some human genes into rabbits by micro-injections, so that the rabbits' milk will produce factor 8 which is used to treat hemophiliacs, Louis-Marie Houdebine, a specialist working at the Jouy-en-Josas INRA, explained.

It is precisely to get this molecule, which is present in human blood and very hard to manufacture artificially, that hemophiliacs were getting human blood transfusions, and were occasionally contaminated with the AIDS virus. Another application about to be achieved is to have rabbit's milk manufacture the hormone that causes red blood cell to multiply.

To the great excitement of the international scientific community, three months ago the Strasbourg INRA, in collaboration with the pharmaceutical division of the Rhone-Poulenc group, managed to create rabbits resistant to arteriosclerosis by implanting in them the human genes that confer resistance to the disease.

The INRA is also researching the implantation of certain human genes on pigs, in order to make the pigs' organs "human" enough to be transplanted in man without being rejected; the organs include the heart, liver, kidneys, and some insulin-producing cells of the pancreas. This research is in the in-vitro stage, but the concept is working, Mr. Houdebine emphasized.

Researchers also managed to implant the AIDS receptor gene (CD4) into rabbits, thus creating rabbits that can be infected by the human AIDS virus. This type of application is of course precious for medical research.

COMPUTERS

Germany: JESSI Enhances Development of New Chip Processes

94WS0276D Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 10 Mar 94 p 10

[Text] Frankfurt—Over the period 1989-1996 the Joint European Submicron Silicon Program, JESSI for short, will receive total funding of 3 billion ECU. Where JESSI has been employed so far the results have been top-rank. This is the opinion recently expressed by JESSI's chief executive, Hans Meyer, at a meeting of the Technical-Literary Society (TELI) in Munich. He said that some partial projects have led to technology transfer between partner companies during the last few months.

Meyer explained the knowledge and the advances that had been achieved with JESSI so far: in the new generations of MOS transistors, tunnel effects can arise at the submicrometer level which reduce the chip's performance. These can now be combatted with two proven production steps, namely the nitride-gate-oxide process and the Large Angle Tilted Implanted Drain (LATID) process.

A further innovation involves the transfer of circuitry structures onto the chip by optical lithography. In wafer-stepper tools the demands for precision grow with increased wafer size. As JESSI researches have shown, even the available steppers can operate with an accuracy of 0.5 micrometers. In this case wave lengths of 365 nanometers are being used. With even shorter wave lengths, an accuracy of 0.1 micrometers is said to be attainable.

Progress in development is also being reported for storage chips of the EPROM type (Erasable Programmable Memory). As has already been reported, JESSI

distributed the first blueprints for a 16-megabit EPROM to partner companies. They were produced using 0.6 micrometer technology.

JESSI was created by the European Research Coordinating Agency (EUREKA) to work jointly on basic technologies for electronic chips and chip production. At the moment 185 institutes and companies are involved, participating in 71 individual projects.

France: CNES Develops Baghera Information Sharing Tool

94WS0306C Paris L'USINE NOUVELLE in French
31 Mar 94 p 52

[Article by T.L.: "CNES Manages its Technical Files With an Object-Oriented Database"]

[Text] *Developed with an object-oriented DBMS [database management system], Baghera is a technical information sharing tool. It facilitates navigation among data and enables accessing according to specialized viewpoints.*

Filing one's data is fine; knowing how to share them is even better. The CNES [National Center for Space Studies] at Toulouse, together with Aerospatiale Satellites at Cannes, chose object-oriented technologies on which to base the creating of Baghera, their technical-data accessing tool. Baghera was developed by the Esprit-Concept company—which markets the software—using 02 Technology's object-oriented database management system. Aerospatiale and CNES have both validated the product on the basis of a project, and are now planning to extend its use.

"In the space industry, each project generates masses of data that must be accessible by all the participants (design bureau, project manager, office responsible for manufacturing, etc...)," says Jean-Luc Le Gal, head of engineering tools integration at CNES. A satellite program, for example, will produce 15,000 technical documents, 11,000 models of CAD, 200 images and photos, and even some 100 video sequences describing components-integration methods.

Maximizing Simplification of Information Access

The role of a tool such as Baghera is consequently that of facilitating the filing and accessing of these data of very different natures.

The primary need expressed by the future users of the system was utter simplicity of access to the information. "After a comparative test between a relational database and an object-oriented one, the latter was chosen, because it enables free-ranging navigation within the data," says Andre Labat, CEO of Esprit-Concept. In Baghera, the data are structured in the form of a technical flow chart. The user need only click at the nodes of the flow chart to obtain, step by step, all the plans, documents, images, and video sequences desired. By clicking at a CAD model displayed on the screen (a

satellite), the user can select a component and obtain the manufacturing drawings, video of its integration, etc. Adding to the database is simplified, since creating a component in a project means adding an object into the base.

The other problem that arose in the design of the CNES's database was the diversity of its potential users. Each user needs to quickly obtain the information specific to his or her specialty. Baghera resolves this problem by making it possible to construct a specific organization of data, around the reference base, for each specialist. This system of "viewpoints" enables the design engineer, the project manager, and the fabrication engineer, for example, to access the data by the means with which each is familiar. Thus, the designer of a propulsion system will first display its schemas. But upon clicking at a piece of equipment, the designer will obtain its manufacturing drawings, lists of components, a video sequence of its assembly, etc. The links created among objects correlate the data modules corresponding to the different viewpoints, and maintain the coherence of the whole. This capacity for adding to the modes of access to information is being used to advantage at CNES and Aerospatiale to gradually bring their different services around to using the database.

A Promising Technological Marriage

The marriage between object-oriented technologies and DBMS's goes back beyond just yesterday. The first object-oriented DBMS's came into being in 1988, and since then this niche has seen a relatively sizable growth featuring products such as: ObjectStore by Object Design, the market leader, whose French subsidiary was created toward the end of last year; Ontologic's Ontos; Servio's Gemstone; Versant and two French products that have succeeded in asserting themselves in this emerging market; ADB's Matisse; and 02 Technology's 02. To the conventional functions of the relational DBMS, the object-oriented DBMS adds its ease of adaptation and extension, as well as a respectable ability to manage complex and multimedia data. Technical-data processing is well represented in applications such as CAD, technical databases; network management, geographical data systems, etc... But the management environment is becoming increasingly aware of the advantages of object-oriented DBMS's.

DEFENSE R&D

Germany: Industry Requests Additional Funds for Eurofighter

94WS0331C Paris AFP SCIENCES in French
14 Apr 94 p 13

[Text] Bonn—German manufacturers are asking the Bonn government to allocate an extra 570 million German marks [DM] for development of the European combat plane (Eurofighter), announced state secretary Jorg Schonbohm 13 April.

The government, Schonbohm added before the parliamentary defense committee, is prepared to negotiate an additional DM160 million for project modifications and extension of the fighter's development phase. On the other hand, it has rejected all other requests, including adjustments for inflation.

Germany, Italy, Spain, and the United Kingdom agreed to develop the Eurofighter 2000 in late 1992, as a (30-percent) less costly alternative to the initially planned European Fighter Aircraft (EFA). They also agreed to postpone the aircraft's production phase. The German defense minister already spurned several manufacturer requests for additional funding last year.

The government wants to reach an agreement on the question with participating firms by the end of May, and inform the lower house of parliament, the Bundestag, of the outcome before summer. A Eurofighter prototype made its maiden flight on 27 March, over one year behind schedule. Its official presentation is slated for 4 May. Germany is underwriting one-third of the project's cost.

France: Government Seeks NH90 Helicopter Program Downsizing

94WS0331D Paris AFP SCIENCES in French
14 Apr 94 pp 13, 14

[Text] Paris—The NH90 military helicopter program launched by the Franco-German group Eurocopter "will be maintained" but "downsized," announced the French minister of industry, foreign trade, and postal services, Gerard Longuet, before the National Assembly 13 April.

In reply to a deputy's question, Longuet said that "Defense Minister Francois Leotard himself will present the extent" of the scaleback, "which will in no way affect the activities of the Marignane and Courneuve companies." "The export success and civil potential of the helicopter—since it has transport potential—will make it possible to support the project," in Longuet's opinion. The minister described the program as an "absolute duty," "both for its military users, the army and navy, and for Eurocopter company."

Minister Longuet pointed out that the program was costing France 4.7 billion French francs [Fr]. French orders for 220 helicopters (160 for the army, 60 for the navy) would probably run up a bill of nearly Fr50 billion. The French market represents 40 percent of Eurocopter's future workload.

The NH90 helicopter is being developed in partnership with Germany, the Netherlands, and Italy. The development contract was signed in 1992. The 1995-2000 military appropriations bill, which was recently submitted to the French head of state, favors equipment under manufacture at the expense of programs under study or development (prototype construction stage), such as the NH90.

France: Charles-de-Gaulle Aircraft Carrier to Track 1,000 Potential Threats at Once

94WS0331E Paris AFP SCIENCES in French
14 Apr 94 pp 15, 16

[Text] Toulon—"Every navy in the world, including the American, already envies us the Charles-de-Gaulle's combat system. It will enable the French aircraft carrier to track 1,000 leads (or potential threats) simultaneously, identify them, and respond as needed," assert electronic engineers of the Directorate of Naval Shipbuilding (DCN).

At the tip of the Saint-Mandrier peninsula in Toulon, the system's designers have installed a life-size mockup of the future aircraft carrier's mast, which rises 74 m in height (10 more than on the ship). Over the months, they will use it to fine-tune integration of the different radar, radio, and electronic systems that make up the "eyes and ears" of the Charles de Gaulle, in a real marine environment.

Real tests employing aircraft and ships will provide step-by-step verification of work quality, software, computers, consoles—and the whole lot's compatibility. Laboratories will continue ergonomic studies to design the 24 consoles that make up the heart of the Naval Tactical Information System (SENIT-8), which operators will work in four-hour shifts.

Everything must be ready in January 1988, when France's first nuclear aircraft carrier will begin its official, 15-month testing period. Until then, there is plenty of work to be done in Toulon, and in the some 200 French and European companies acting as subcontractors.

An unusual feature of the system is that its components were purchased on the commercial market, then "hardened" for military needs. This approach will enable engineers to upgrade all or part of the on-board electronics every four years, as technology changes. It also saved money from the outset: of the 17 billion French francs [Fr] the Charles-de-Gaulle will cost, Fr10 to 12 billion are earmarked for the ship itself, and 25 to 30 percent for the combat system.

The latter must manage all the information transmitted by its six radars, the radars of the naval group's other ships, early warning planes (AWACS or Hawk-eye), and the data supplied by the three satellite systems, Inmarsat, Fleetsatcom, and Syracuse. The combat system must control the launch of defensive weapons (aircraft, missiles, helicopters, decoys, etc.), and keep the carrier in uninterrupted contact with the Navy general staff, its base, any land commandos in operation, its aircraft, the French president, and the ship's internal communication system.

Consequently, the Charles-de-Gaulle—whose hull will be launched 7 May in Brest—will be packed with electronics. In addition to its radars, it will boast 80 different antennas, each able to carry four to five transmissions.

To avoid interference, engineers are experimenting with different placement patterns on a copper mockup 1/50th the actual size of the ship.

Color symbols for each type of threat appear on the consoles of the operations center. The system's eight computers will identify and track them, rating them on a scale of rising danger. Once the threats' fate is sealed, the decision to destroy them, whether they are aircraft, missiles, ships, or torpedoes, is made and implemented. The naval group plays a role in protecting the aircraft carrier.

The area surrounding the Charles-de-Gaulle is broken down into four zones. At a distance of over 100 nautical miles, pursuit is guided by an on-board early warning Hawkeye plane (the ship will carry three) or a destroyer. Between 50 and 100 nautical miles, the aircraft carrier's planes (Rafale or Super Etendard, etc.) or the nearby aerial defense support ships will take over. Between 15 and 50 miles, fighters and medium-range missiles will engage the threat. Finally, in the first zone of 15 miles or under, the aircraft carrier's on-board defense weaponry will respond. Naturally, the carrier's weapons must avoid shooting down friendly aircraft. "On 6 June 1944," says destroyer captain Guillot, "90 percent of air losses were caused by the allies themselves, due to lack of coordination."

Since the Charles-de-Gaulle will often be traveling in international waters—as the Foch is, off the coast of Yugoslavia—all communication systems have been made compatible with those of our allies. Hence the visits of experts from other navies and their enthusiastic comments, which the DCN plans to use to "sell" the SENIT-8's "forerunner"—the SENIT-6 which equips the anti-aircraft destroyers Jean-Bart and Cassard—on the international market. Yet the SENIT-6 can only monitor 240 potential threats at one time....

France: 1995-2000 Defense Expenditures Proposed

94WS0322A Paris L'USINE NOUVELLE in French
7 Apr 94 p 25

[Article by Jean-Francois Jacquier: "Weapons Manufacturers Asked to Scale Back Their Costs"; first paragraph is L'USINE NOUVELLE introduction]

[Text] **The worst has been averted. But since the new appropriations bill cannot pay for everything, costs will have to be cut!**

The 1995-2000 military appropriations bill, which defense minister Francois Leotard describes as "99-percent wrapped up," is slated for presentation to members of parliament on 20 April. Though less than enthusiastic, those most concerned by the package—the chief contractors for military programs—are visibly relieved. Plans for a 0.5-percent volume increase in annual equipment spending over the next six years make defense look relatively spoiled.

But problems remain. Experts are unanimous that funding programs which are reaching maturity would have required "an annual 3-percent increase in the volume of appropriations." The difference will be made up, first of all, by asking weapons manufacturers to cut costs again. To that end, Francois Leotard organized a meeting last Thursday with defense company CEOs, who are prepared to acquiesce in the defense minister's request. General weapons delegate Henri Conze has targeted productivity gains of two percent a year. "We should make it," says Daniel Rapenne, general director of Thomson-CSF. "In the past, the use of (less expensive) non-military components for certain programs produced much greater gains." But such a switch presupposes coordination with the DGA as well as lower performance demands from the general staffs. Moreover, this type of cost-cutting can only be implemented for programs whose designs are not yet finalized, and which have not reached the industrialization stage. The Tigre and NH 90 (Eurocopter) helicopter programs may be put on a such a cost-conscious diet.

But that will not be enough to stay within the total package of some 615 billion French francs [Fr], especially since geostrategic planning has highlighted other needs in the areas of conventional equipment and force deployment capability.

Inevitable Adjustments

For instance, the new appropriations bill included the launch of a tactical transport plane, the FLA (Future Large Aircraft), to replace now obsolete Transalls. Germany seems interested in signing on to the program, which would provide a workload for Airbus partners, but will require France to invest at least Fr33 billion. Further adjustments of programs in progress, in addition to those made recently, thus seem inevitable (see table).

The fact is, France can no longer afford the structural increase in costs caused by the growing sophistication of modern weapons systems. For anyone who reads between the lines, the new appropriations bill will confirm this. The only way out of the vicious circle is to accelerate the European mergers for which the DGA (General Weapons Delegation) has been calling and all manufacturers have been preparing.

Uncertainty in the Electronics Industry

With turnover of Fr36.6 billion in 1993, the electronics industry, which does 63 percent of its business with the defense sector, posted its fourth straight decline (12 percent). Total business has dropped by about 25 percent since 1990. But Jean Climaud, president of SPER (Trade Union of the Electronics and Radio Industries), thinks he sees a few breaks in the clouds. A notable cause is the stabilization of military appropriations in 1994. The new military appropriations bill will not prevent painful choices, and with that in mind, SPER suggests concentrating on France's strengths, namely guidance, communication, and information systems; electronic warfare;

and optronics. Moreover, the need to further boost the industry's competitiveness will prompt new reductions

in staff, which will have to drop from 44,000 today (50,900 in 1990) to 42,000 in late 1996.

New Threats to Big Programs

Programs	Chief Contractors	No. to Be Manufactured	Cost in Fr Billions	Threats
M5, ship-to-surface nuclear missile	Aerospatiale	48	40	Limited development funding; start of service date postponed from 2005 to 2010
Nuclear aircraft carriers	DCN (Naval Shipbuilding Directorate)	2	33 (including surveillance aircraft)	Launch of the 2nd aircraft carrier delayed to 1997 or later
Tigre (combat helicopter)	Eurocopter (Franco-German joint venture)	215 for France	36	Costs scaled down
NH 90 (transport helicopter)	Eurocopter (joint venture of France, Germany, Italy, and Holland)	220 for France	41	Scaled-back specifications; total cost cut 20-30%; program highly threatened; German hesitation
Rafale	Dassault	320	178	Possible reduction in orders
Leclerc tank	Giat Industries	650	40	Original plans for 1,400 reduced to 650 and possibly 400

France: Triomphant SSBN Launched

94WS0294C Paris AFP SCIENCES in French
31 Mar 94 p 20

[Article: "SSBN Le Triomphant Launched"]

[Text] Cherbourg—The SSBN [nuclear powered ballistic missile submarine] Le Triomphant was launched on 27 March "in perfect technical conditions," according to an announcement on the 29th by the Directorate of Naval Shipbuilding and the Maritime Prefecture.

A military source explained that the launching consisted of filling the dock where the submarine had been built. The submarine will soon leave the dock and submerge at sea to a depth that may reach 70 meters, the same source added.

Following a brief cruise off Cherbourg, it will go to Brest—the site of the French SSBN base—early in May to begin its sea trials, which will last about a year. At that point it will be declared operational, according to the same source.

The cost of the Triomphant program—a total of four submarines are planned—is estimated at some 80 billion French francs.

France: 'Le Triomphant' SSBN to Begin Sea Testing

94WS0321B Paris LE MONDE in French
23 Apr 94 p 16

[Article by Jacques Isnard: "The New Strategic Sub 'Le Triomphant' to Begin Its First Tests in the Atlantic"; first paragraph is LE MONDE introduction]

[Text] Defense minister Francois Leotard was scheduled to visit Cherbourg on Friday, 22 April, to view the latest of France's new-generation submarines, Le Triomphant. The underwater craft will travel to its Ile-Longue operational base in Brest in early May. Ten years after initial drawings, Le Triomphant—which will be followed by three other missile-launching nuclear submarines of the same type—will prepare to set sail for its sea tests from Brest. The ship will be declared "ready for active service" in the summer of 1996.

Now under the command of ship captain Francois Dupont, Le Triomphant was put on slipway at the Cherbourg naval shipyard directorate in June of 1989. But the first studies for the submarine began over 10 years ago, and it has been 8 years since the first piece of sheet metal was welded in place.

The goal with Le Triomphant was to build as quiet a submarine as possible, able to fire more sophisticated nuclear missiles than those carried aboard such first-generation ships as Le Redoutable and its enhanced version L'Inflexible. Hence Le Triomphant's undersea tonnage of 14,355, against 8,920 metric tons for its predecessors. This huge underwater displacement is similar to that of modern submarines in service in the United States and Russia, which meet roughly the same technical criteria.

Engineers made four specific design choices to reduce radiated noise and make Le Triomphant quieter during operations. First, they equipped it with a steel hull of very high elastic limit so that it could dive deeper (beyond 300 meters). Second, they made the submarine more hydrodynamic and streamlined its propeller.

Finally, they insulated propulsion and auxiliary installations from the hull and suspended them on springs to avoid vibrations and shocks.

A Fr81 Billion Program

Likewise, *Le Triomphant* carries renovated weaponry. In addition to defensive weapons consisting of torpedoes and Exocet SM39 submarine-launched missiles, the submarine will transport 16 M45 missiles. Each M45 can disperse six nuclear warheads—staggered over time or space—that can strike targets more than 6,000 km away from their underwater launch point. Moreover, the M45 features penetration devices and electronic countermeasures to help it thwart enemy defenses.

France has decided to begin building three other submarines of the same model, two of which, the *Temeraire* and the *Vigilant*, have already been named. In the past, the Strategic Ocean Force has included as many as six strategic submarines. By 2005, that number will have dropped to four. Construction of the four new submarines is estimated to cost a total of Fr81 billion, not counting spending on the M45 missiles. The decision whether to replace the M45 in 2010 by a missile dubbed M5 is not expected to be made before 1997.

Following Leotard's on-board tour, *Le Triomphant* will sail to the Ile-Longue base, in the Brest roadstead, between next 2 and 4 May. It will be presented to Francois Mitterrand on 7 May when the head of state travels to Brest to witness the launch of the first French-built nuclear aircraft carrier, the *Charles-de-Gaulle*. The prime minister is scheduled to join the president on his visit to *Le Triomphant* submarine.

During the following two years, the submarine will perform a series of sea trials—a crucial step before it enters active service, i.e., makes its first operational patrol. The tests to enable the crew—two rotating crews of 110 men each—to learn how to handle the ship at maximum submersion will take place in the Atlantic. *Le Triomphant* will later effect a full-scale launch (minus the explosive charge, of course) of an M45 missile, and fire torpedoes and SM39 missiles. This will enable the Permanent Programs and Testing Committee (CPPE), which makes proposals concerning the rating and active service acceptance of the submarine to the general staff, to hand down its verdict. Active service is slated for the summer of 1996.

France: Defense Minister's Announcement on Helios II Program

94P60225A Paris/LE MONDE in French 30 Apr 94 p22

[Unattributed article: "Mr. Leotard Launches New Satellite Program's Defining Phase"]

[Text] On Tuesday, 26 April, Defense Minister Francois Leotard announced his decision to launch the Helios II military observation satellite program's definition phase. Presently, although this initiative is purely national in

scope, the French Government wishes other European partners—beginning with Spain and Italy—to become involved with this program's first phase.

In comparison to Helios I (two optical observation satellites, one of which is to be orbited at the beginning of 1995), the Helios II program anticipates the building of four higher-performance satellites. Their additional infrared capacity will permit them to see equally at night and day, during cloudy weather and under bad atmospheric conditions. Helios I has been designed in the mold of Spot-4 civilian program (it uses the same platforms and image storing recorders), the same way Helios II resembles the Spot-5 program. These are 2.5-ton military satellites launched by Ariane. Helios II will follow Helios I beginning in 2001.

The Helios I program, sponsored jointly by Italy (14 percent) and Spain (7 percent), has been estimated to cost 7.5 billion French francs. The Helios II program, a partnership of CNES (National Center for Space Studies), Aerospatiale, Matra and Dassault Electronique, should cost about the same. According to Mr. Leotard, "conservative measures" have been taken because "Italy and Spain, and eventually other European partners, can join the program."

Aerospatiale Warning to U.K. Government on FTA Program's Fate

94P60241A Paris LE MONDE in French
11 May 94 p14

[Article by J. Isnard: "Aerospatiale Warns the British Against their Refusal to Support a European Aircraft Project"]

[Text] Aerospatiale CEO Louis Gallois has warned the British on the consequences that their decision—expected in June—to modernize their military transport aircraft fleet will have in Europe, if the United Kingdom were to buy new Hercules craft in the United States, and thus exclude herself from the European game plan, instead of joining the European FTA (Future Transport Aircraft) program—to replace the (aging) Transalls—for which British industry would get work awarded in return. The fate of 50,000 employees depends on the FTA program.

OPIO (ALPES-MARITIMES)

From Our Special Envoy.

For the first time since its adoption by the Council of Ministers, the military program project has been publicly commented on by one of the most important defense industrialists, Aerospatiale CEO Louis Gallois. During an Aerospatiale seminar that took place on Monday 7 May in Opio (Alpes-Maritimes), he expressed his opinion on this official document by separating the "negatives" from the "positive aspects."

On the side of "negatives," first of all, it is the fact that "all armament programs are either to be staggered or the contracts reduced." On the other hand, there is the issue of "expertise preservation" with respect to ballistic missiles, ramjet engines, Helios-2 and Osiris spy satellites, as well as the "commitment"—coupled to a prefinancing formula in 1997—to the FTA project for Europe. Mr Gallois has been very unyielding to London on the latter program, which, in the estimations of Clauder Terrazoni, the director of the group's "aircraft" division, will cost 25.6 billion French francs [Fr.] for a total of three hundred aircraft.

Normally, it is next June when the British should say whether they will participate in the FTA project—along with the Germans and the French, who wish to replace the Transalls, but also along with the Italians, Spaniards, Portuguese, the Turks and Belgians—or prefer to buy Lockheed's C-130 Js. The British need 60 aircraft.

NH-90 Helicopter to Default.

"But, if Great Britain does not want the FTA, the program will go on without her, and she will have no work contract awarded. The taxpayers on the continent could not comprehend the need to finance the part of a work that is to be given to a country not willing to participate in the project." Aerospatiale CEO has suggested to the British that if they were in such a hurry to modernize military fleet transport, a solution would be for them to "upgrade" their present Herculeses in stock, "while waiting for the arrival of the FTAs." "London's decision," Mr Gallois concluded somewhat solemnly, "is charged with consequences."

Concerning France's ambition, expressed in the program project, to launch a (feasibility) study for a new, over 600-km-range accuracy guided missile named APTDG, Mr. Gallois presented the candidacy of his group opposite to Matra's. According to Jean-Louis Fache, chief of "missiles" division, Aerospatiale's experience accumulated in ramjet propulsion, enables the group to design "a family of supersonic missiles starting from a common technological base," something which might lead to a 5-to-10 percent cost reduction per unit. As Mr. Gallois admitted, "If the solution chosen will be the ramjet, the question will arise as to cooperation with Matra."

Finally, Aerospatiale's Eurocopter subsidiary—in partnership also with the German DASA—through the voice of its CEO, Jean-Francois Bigay, has alluded indirectly to leaving the NH-90 logistic (support) helicopter project, eliciting thus protests of seven different armies in Europe, the French army and navy included.

Officially, the NH-90 program was launched in 1992, based on a multinational agreement and a development cost estimation totaling Fr10 billion over nine years. "All disclaimers," Mr Bigay warned, "will result in the cancellation of a commercial contract," with penalties imposed by the ones affected to the withdrawing signatories. "We are ready," he added, "to consider this helicopter forfeited." Mr. Bigay made it clear that the

NH-90 should not exceed Fr85 million (excluding taxes) per unit, and that in the present state, development cost reductions exceeding 30 percent cannot be imagined—as this has been demanded by France from Eurocopter—without sharply downgrading this European helicopter's operational performance.

Italy: Aeronautical Research Center's Activities Outlined

*M11404101994 Milan ITALIA OGGI in Italian
11 Mar 94 p 15*

[Article by Marco Tavasani: "An Aeronautical Studies Center"]

[Text] A branch of the armed forces like the air force has a need to invest large sums to test and study the equipment and materials that it possesses and those that it will adopt in the future.

Even the human factor (the pilots and the specialists) represent an important heritage that needs to be optimized; this leads to the need to unite the research centers dedicated to in-flight testing, the chemistry of materials, armaments, computers, and aerospace medicine under a single command in the aeronautical research, study, and testing center that is located near the Pratica di Mare base, on the Lazio coast south of Rome.

Rather than being a large military unit, the testing center is a complex laboratory where the aircraft and all related systems (including armaments and electronic equipment) are tested before being assigned to the flight divisions.

Under certain aspects the Pratica di Mare division can be defined as being the Italian version of the Edwards Air Force Base, because among the 687 military and civilians that work there are also 15 testing pilots whose responsibility it is to test the Air Force aircraft and helicopters in flight, but also those of the other armed forces and government bodies. The in-flight tests are conducted not only on newly-acquired aircraft (the more recent ones are the AMX fighter bomber and the P180 executive twin engine), but also the modifications that experience suggests should be made, and the upgrading during the operating life.

The most complex phase definitely concerns the flight tests and prototype approval: thanks to a sophisticated telemetry system, up to 400 parameters ranging from the aerodynamic performance to engine temperature and performance, to the behavior of external loads (bombs, missiles, containers for recognition instruments) are transmitted to the aircraft, processed by a series of computers and displayed on the monitors of the ground stations.

Here it is possible to follow the behavior of the aircraft moment after moment, and to intervene, suggesting to the pilot which corrections should eventually be made. One of the most interesting divisions is the laboratory

for the chemistry of materials, which courts resort to increasingly for the delicate technical appraisals and investigations following aircraft accidents.

The center works closely with the leading Italian universities involved in aerospace research such as the Milan Polytechnic, La Sapienza University of Rome, and the University of Pisa, as well as with companies working in the sector of aeronautical constructions and advanced materials.

The studies often have a direct spin-off in the civil sector: this is the case of research into new fuels and lubricants that are of interest to the automotive industry for new generation engines, or into composite materials where it is important to explore the break points with revolutionary methods of investigation, such as laser holography.

The most interesting programs underway include the modification of some Tornados into an electronic war version using Texas Instruments antiradar Harm missiles for the suppression of enemy anti-aircraft defense, and the testing of defense systems against infrared missiles (attracted by the heat of engine exhaust gases) for possible use on the G-22 twin-engine transport aircraft. An aircraft of this kind belonging to the 46th Pisa Air Brigade was shot down by a SAM-9 Soviet infrared missile during a humanitarian flight to Sarajevo two years ago. The laboratories of the division even determined what the missile was by analyzing a 5-millimeter shell found in the engine exhaust nozzle, thanks to the use of an electronic microscope.

An important section is the aeronautical and space medicine division that has focused its studies primarily on stress and immunity and on the problem of the sleep-waking rhythms and the attention levels. This research began with the pilots used on the Tornados during the Gulf War (1991) when the missions began at four o'clock in the morning.

The consequent need to rest during the day, at the end of the flight, led to the identification of a drug that lets people sleep at unusual hours without any collateral effects on the organism. This drug can also be taken by students suffering from stress before an exam.

Italian State Group Buys Into Anti-Missile Control Venture

BR1204092294 Paris LA LETTRE DU GIEAS
in English 10 Mar 94

[Unattributed article: "Alenia Takes Shares in Eisis, a Joint Thomson-CSF and EIS Venture"]

[Text] Via its Alenia branch, the Italian group FINMECCANICA [Mechanical Engineering Finance Corporation] has taken a stake in the Eisis Co., a joint venture created at Rome in 1992 by Thomson-CSF and Elettronica Ingegneria Sistemi (EIS SpA [joint stock company]). The new equity holdings will be: Thomson-CSF

(37.5 percent and EIS SpA (25 percent). For Alenia/FINMECCANICA and for Thomson-CSF, Eisis is a valuable partner for the building of data processing systems for European FSAF (Future Surface-to-Air Family) anti-air systems in which Thomson-CSF and Aerospatiale participate for France and Alenia for Italy under the EUROSAM [expansion unknown] venture.

Eurofighter-2000 Maiden Flight Reported

94P60185A Paris LE MONDE in French 29 Mar 94 p 9

[Unattributed article: "European Combat Aircraft's Maiden Flight"]

[text] The first prototype of the European Fighter Aircraft Eurofighter-2000, the French Rafale's rival, took off for its maiden flight on Sunday, 27 March, from the test field in Manching, Southern Germany. According to the manufacturer, the German DASA group, the 45-minute flight went without hitches. Scheduled for last fall, this first flight had to be delayed due to difficulties encountered in fine tuning the aircraft's electric controls. Seven prototypes will be assembled.

Financed by Great Britain (37.5 percent), Germany (30 percent), Italy (19.5 percent) and Spain (13 percent), the Eurofighter program met with significant vexation, and, when set against the originally established goals, it has been delayed two years owing to technical, industrial and political disagreements between the four involved European countries. Series production is slated to begin only in 1996 or 1997. The global cost (development and production) of all the four hundred crafts ordered is evaluated at \$47 billion (i.e., 268 billion French francs).

At the time of the program's launching, the four countries had announced their intentions to buy more than 760 Eurofighter planes. But the cost of the aircraft had forced Germany to tone down its ambitions, going as far as to quit the program altogether if the price of an aircraft could not be reduced by 30 percent. Italy and Spain are in the same mind frame. Only the United Kingdom, for which this is a unique military aircraft under consideration, let it be known that it could buy more.

France: Defense Minister Declares NH-90 Helicopter Essential

94P60185B Paris LE MONDE in French
25 Mar 94 p 11

[Unattributed article: "The European NH-90 Helicopter Program is Judged Essential by Mr. Leotard"]

[text] In a letter to Olivier Darrason, the Bouches-du-Rhone UDF (French Democratic Union) representative in charge of a ministerial committee for the European NH-90 logistic (support) helicopter program, the minister of defense, Francois Leotard, evaluated the NH-90 "as being essential for our (France's) (armed) forces and for the future of the Eurocopter group."

"Moreover," the minister continued, "the Government considers the aerospace programs to be real priorities. In spite of the difficult budgetary and financial context, according to the prime minister's first evaluation of defense programs, our defense modernization is allowed to continue."

Before the National Assembly's Defense Committee, the Eurocopter group's president, Jean-Francois Bigay, stated that "the cost of the NH-90 program has been 1.376 billion ECU," that is, more than 1.3 billion French francs [Fr]. The French participation stands at 42.4 percent (Fr1.3 billion for Eurocopter France and Fr3.9 billion for the French Government). Then Mr. Bigay added: "The cost per unit of an NH-90 is Fr85 million" for the army, "and Fr135 million" for the navy models.

The four countries participating in the program (France, Germany, The Netherlands, Italy) ordered a total of 726 crafts, while the export market, outside Europe, has been estimated at approximately 500 "machines." Today this program is very much endangered by reductions of the defense budgets in the four participating countries.

ENERGY, ENVIRONMENT

Germany: BASF Inaugurates Plastics Recycling Factory

MI1905081194 Bonn DIE WELT in German
26 Apr 94 p 22

[Article by Michael Wendel: "Black Gold From Plastic Waste: Plastics Recycling Will Channel Packaging Floods—Pilot Plant Starts Work This Week"]

[Text] About 10 million tons of plastics and elastomers are produced and processed throughout the year in the German plastics industry. In 1993, more than 280,000 tons ended up in the yellow Dual System (DSD) collection sacks as packaging waste. DSD managers expect 440,000 tons of plastic packaging bearing the green dot by the end of 1994, the plastics mountain for recycling being expected to swell to 750,000 tons by the end of 1986—much more than the recycling capacity currently available in Germany. However, the much-prophesied waste flood by no means rattles the top DSD people, who are temporarily afflicted by tight finances and reprocessing bottlenecks. They are placing their trust in a confident promise made by Plastics Manufacturing Industry Association chairman Albrecht Eckell: "The problem of plastics recycling will have been cracked by the end of 1998."

The magic formula is reprocessing into raw materials. Instead of just melting plastics down to make park benches, flowerpots, and noise insulation panels, yogurt pots, detergent bottles, and similar waste will be used as sources of raw materials. This week, the BASF chemicals group (on whose board Eckell sits) is bringing on stream a pilot plant in Ludwigshafen, where ground-down plastic waste will be liquefied at 400°C then split into oils

and gases. Up to 950 grams of petrochemical products will be distilled in this way from every 1,000 grams of plastic and used as raw materials in the BASF factories. The PVC [polyvinyl chloride] component will be separated out as Javelle water and processed in the hydrochloric acid works. The plant, claims a BASF brochure, will operate without pressure in a closed system, so it will discharge "virtually no emissions."

The 40-million German mark [DM] pilot plant has an annual recycling capacity of 15,000 tons. The follow-up model, which is scheduled to come on stream early in the summer of 1996, is of a different caliber: It can reprocess up to 300,000 tons of contaminated, unsorted DSD packaging—sufficient volume, together with the VEBA [United Electricity and Mining Works AG] coal-oil plant in Bottrop (170,000 tons) and the RWE [Rhineland-Westphalian Electricity Works] plant (70,000 tons), to meet the requirements of the Packaging Regulation until that date.

The new industrial-scale technology admittedly has one drawback: These expensive plants—BASF's investment will amount to DM300 million—must keep running, so they need a constant plastic waste input. This does away with the incentive to avoid creating packaging waste. In order to ensure supplies of DSD material, BASF is also working with the Cologne-based Otto Group, whose annual sales of DM1.3 billion make it one of the giants on the waste disposal market. Group chairman Otto answers objections that central plastics recycling will speed up the polarization process in the industry by pointing out that small and medium-sized disposal firms could participate in a "nationwide project" at 15 regional logistical centers.

Plastics recycling does not come cheap. The Dual System pays BASF DM325/ton—about a 10th of the cost of producing a ton of recycled raw materials, collection, sorting, and separating the packaging waste taking the lion's share. One ton of crude oil costs DM200 on the world market. In the ultimate analysis, the consumer has to pay for it as well at the checkout—the "green dot" is what makes this possible.

Germany: Heavy Metals Immobilized, Hydrocarbons Degraded

MI2005151794 Wuerzburg UMWELT MAGAZIN
in German Mar 94 pp 117-118

[Text] Soil contamination with combinations of toxic substances, such as hydrocarbons and heavy metals, often present major problems. Low-cost biological reclamation processes are ruled out in most cases, and all that remains are costly soil washing or heat treatments or dumping.

Markkleeberg-based Biolipsia GmbH has developed a gentle two-stage process for this area. In the first stage, the adsorption agent Metasorb B is added and thoroughly mixed into the soil material, which is ground down to grain sizes of less than 20 mm. All the heavy

metal ions present—even chromium—are securely bound, and after a reaction period ranging from a few hours to a few days, hardly any bioavailable heavy metal ions remain in the material. This process is irreversible over a very wide pH range.

Biological Degradation in Biobeds

In the second stage, the organic contamination can be eliminated in biobeds. The pretreatment has bound all the heavy metals to the extent that they have no inhibiting effect on the enzymic activity of the bacteria that degrade the hydrocarbons. Other nutrients required for pollutant degradation, such as alkaline or earth-alkaline ions and phosphoric and nitrogenous salts, are not bound by the adsorption agent.

The company has performed successful laboratory tests over the last few weeks, where adding Metasorb in a ratio of 5 to 10 percent by volume of the soil being treated achieved degradation rates ranging from 35 to 85 percent of the initial concentrations after a 15-hour mixing period followed by the degradation test—with prefermented biomass over 24 hours. The producer's initial findings indicate that the process is economically viable, as the cost per tonne is only DM25 to DM80 higher than with purely microbiological processes.

If biobed treatment is prolonged sufficiently, the hydrocarbon concentrations can be reduced to the extent that the material can be used for reincorporation. Long-term trials in Belgium have shown that no discharge of heavy metals into groundwater-bearing strata need be feared.

Germany: Recycling Lead Batteries in Freiburg

94WS0307C Berlin *INGENIEUR DIGEST* in German
Mar 94 p 46-47

[Article by Herb Stanschus: "BAT For Lead Accumulators: Muldenhuetten Freiberg Soon to Have Europe's Most Modern Plant"]

[Text] Technical Managing Director Hans-Peter Behrendt says happily that something like 55,000 tons of lead and other materials will be recovered from approximately 5 million used batteries "with the most modern plant in Europe." The secondary lead refining plant at Muldenhuetten in Saxony will be modernized at an investment expense of DM30 million.

The project is being presented by the company Recycling und Umwelttechnik GmbH [Recycling and Environmental Technology] at the TERRATEC in Leipzig. It is contributing to the continuation of a positive trend: lead release into the environment has been reduced by 80 percent since 1985 in Germany. Muldenhuetten, which was first mentioned in 1395, has a tradition in this area. Silver production was followed there by the production of lead, zinc, arsenical compounds and sulfuric acids.

The company was adapted through technological improvements and new buildings to a capacity of 70,000

tons of secondary lead annually during the GDR era. A record chimney 200 m high became the new, widely visible trademark of Muldenhuetten. However, its environmental friendliness was limited to distributing the high sulfur dioxide emissions—they arose among other things through the thermal decomposition of the lead paste—widely over the surrounding countryside. In addition, the lead recycling process was very energy-intensive and yielded all kinds of waste: plastic components from the used batteries could not be reprocessed.

After reunification Muldenhuetten was threatened with closure. "It could only be averted by a solid solution from the private sector," Behrendt sums up. The Muldenhuetten business group was detached from the former GDR collective combine Saxonia AG. In 1992 the Muldenhuetten Recycling und Umwelttechnik GmbH was created as a subsidiary of the Rheinische Zinkgesellschaft [Rhine Zinc Company] of Duisburg.

The group in the Erz Mountains also came in contact with an experienced sister company on the Rhine, the BSB Recycling GmbH in Braubach with a related kind of production: accumulator recycling. It is true that they used a process which was categorized by the U.S. EPA as "BAT": best available technology.

This engineering process which had proved itself in the Braubach model plant is now the center of the refitting in Freiberg. The used batteries were completely disassembled using the principle of updraft sorting—a prerequisite for the recovery of all valuable components.

These are the major steps in the process: first worn-out starter batteries—in acid-proof containers—are brought to the factory in an environmentally safe manner and stored in a protected place.

The next step is mechanical disassembly and separation into electrodes, lead oxide-lead sulfate mixture, polypropylene, ebonite, PVC and used acid. The desulfurization of the sulfate-containing portion of the paste with alkalis produces desulfurized paste and sodium sulfate solution.

Then the charge mixtures are combined and smelted in short drum furnaces with high-efficiency filters for waste gas cleansing. The raw lead is refined and alloyed and cast into marketable form.

The new technology brings along with it many pluses for the environment. For example, the guidelines of the TA for air on the limits for toxic emissions are exceeded, in the case of dust and lead sometimes by up to 75 percent. Production becomes almost free of waste. The desulfurized lead paste is melted down and cast along with the grid metal; most of it is put back into battery production.

Polypropylene, from which the battery cases are made, can be recovered with a purity of 99.5 percent. In the form of compounds, which correspond to new materials in quality, they go out to plastics processors and are reused, for example, in building groups of the automobile industry.

Used sulfuric acid is completely recovered and can also be used again. The sodium sulfate which arises during paste desulfurization is raw material for the cellulose, glass and detergent industries. "Our sodium sulfate will have detergent quality," Behrendt promises. All that is left of the accumulators in the end is ebonite and PVC—about seven percent of the total weight; an efficient solution to reintroduce them into the economic cycle still needs to be developed.

The air is becoming cleaner in the Mulden valley and its surroundings: the sulfur dioxide emissions have been reduced to less than 10 percent compared to the earlier process.

But the Freiberg group is not satisfied with the traditional Braubach technology. They want to be the leaders in Europe in recycling. "We are using the opportunity to incorporate the newest technological details," technical head Behrendt explains. This includes improved short drum furnaces as well as slit screens with finer mesh in the sorting phase; the milling stage for polypropylenes is completely omitted.

In Muldenhuetten refitting is in full swing at the moment while production continues. By mid-year the simultaneous gain will have to come to an end. Refitting for the engineering technology process requires the cessation of the old production. But then the number of employees will also have to be reduced, from the current 200 to 150 when modernization has been completed. For the two old, environmentally harmful blast-furnaces in the refinery which still remain will be shut down.

The Freiberg people still have one worry: their West German parent company, the Rheinische Zinkgesellschaft is a subsidiary of the Frankfurter Metallgesellschaft [Frankfurt Metal Society] AG. The giant company is on the verge of bankruptcy because of mismanagement. A banking consortium staved off the worst at the beginning of the year—for Muldenhuetten too, it is to be hoped. "The situation scarcely affected us here," says managing director Dr. Hans-Joachim Kessler with relief. And he adds, as a kind of option on the future: "We will not be a burden to the Metallgesellschaft."

Germany: Recycling, Waste Management

94WS0347A Berlin *INGENIEUR DIGEST* in German
May 94 p 45-47

[Article by Rainer Althaus: "Gentle Recycling"]

[Text] *Each year some three million tons of plastic waste material are generated in Germany. Barely one-sixth of that amount is recycled. Commencing in 1996, in accordance with the second stage of the packaging ordinance, one million tons of plastic containers will be directed to the already overloaded recycler. Some practical solutions for waste recycling were discussed at the ENTSORGA Trade Fair in Cologne in mid May.*

The chemical industry, the manufacturers of plastic articles, waste managers, the uncertain public, environmentalists, and the various politicians are engaged in a highly controversial "religious war" involving the recycling of plastic materials, the environment, and money—lots of money. Only one thing is certain in this war. As Professor Doctor Helmut Kaeufer, the nestor of the German plastic products recycling effort, puts it: "We are in the initial stages of building an entirely new industrial field."

Just what form this new industry will take remains uncertain. Summing up the present state-of-the-art, Kaeufer says: "The chemical industry is giving me a real fight, and if I were in their position I would too."

The difference between the plastics specialist from Berlin and the multinational chemical industries and waste managers lies in one small, but very important detail. The chemistry professor insists on gentle, product-oriented, material-specific recycling, while the industrialists want chemical and raw-materials recycling. The difference is that the Kaeufer approach calls for the old plastics to be reformed directly into new plastic products. However, the professor's approach is still by no means entirely satisfactory. The chemical industry favors reconvertng the waste products into petrochemical raw materials (naphtha, olefins, aromatics, synthesis gas). Commencing in 1996, some 300,000 tons of used plastics a year are to be recycled in this way in Ludwigshafen. Already 5% of this target amount is being so converted in a pilot plant, costing DM40 million, that went into operation in April. The final plant design is expected to cost several hundred million German marks.

BASF AG and OTTO Plastics Service praise their process as a milestone in recycling and describe it as "an ecological and economic recycling alternative for mixed and impure old plastics." As a counterstrategy, they are publicizing "the permanent availability of plastics within the framework of a dual system" and "a definite plus for recycling." The reason for this is simply that neither raw-materials recycling, nor any other recycling or disposal method, is as yet economically profitable.

Moreover, Kaeufer considers reversion back into a raw material to be efficient only for the 20% of the old plastic products which cannot be recycled any other way. New products can only be produced from raw materials through labor- and power-intensive processes. On the other hand, used single-type materials can be remelted through the use of a fraction of the power requirements. In addition, raw materials recycling destroys the innovative-promoting incentive to produce products that can be easily recycled.

The collection and sorting of the different pure-type plastics that Kaeufer's technology requires is expensive and time-consuming. And despite all the propaganda concerning the recycling "boom industry," the available industrial capacity to accomplish it is inadequate. As a result, the recycling industry is replete with scandals. Just

recently 61 shipboard containers turned up in Vietnam with over 1,000 tons of filthy plastic bags, which must now be returned to Germany whence they came.

Against this background, the advocates of environment-friendly recycling fear that waste incineration, charitably called thermal recycling, will be increasingly used as the solution for recycling problems. In the face of the pressing waste problems throughout the country, the resistance of the State environmental ministers and the Federal Environmental Agency is rapidly melting.

A change in the packaging ordinance, which currently prescribes materials recycling, can be anticipated. Product recycling does more harm to the environment than product removal. Unfortunately, convincing evidence of this is only available in individual cases. Researchers and developers who have prescribed material-specific recycling are disappointed. For example, Dr. Norbert Eisenreich, a Fraunhofer scientist in Pfinztal, Fraunhofer, complains: "We have been proposing a type-sorting technology for plastic waste since 1992, but industry remains skeptical. That's the way it is with Toepfer's environmental protection laws. First, things are hurried into being, but then they are not really followed through."

Dr. Hartmut Lucht, the head of Laser Laboratory Adler-shof (LLA) in Berlin, is also dejected: "The DSD (Dual System Germany) does not focus on type-sorting. The disposal managers get their money simply by separating out the plastic waste and pressing it."

But there are encouraging signs:

- Europe's most modern, DM30 million recycling plant—the VEKA Environmental Technology GmbH for windows, shutters, plates, and profiles made of PVC has been in operation in Behringen, Thuringen, for months. Because of PVC's chlorine content (comprising 10 to 15% of its total mass, this controversial plastic is especially advantageous for long-service-life products in the construction industry and, according to the latest eco-reports, is more desirable than aluminum or wood. Old PVC can now be recycled into new window profile sections. These frames consist of 80% recyclates and 20% new PVC for the outer layer. Even the old GDR plastic windows made of wood and plastic casing can be recycled in Behringen.
- After two and a half years of developmental work, the Poschmann Company of Luedenscheid, a producer of precision parts made from expensive thermoplastics like polyamides and polycarbonate (DM6 to DM10 per kg), succeeded in processing old parts into a recyclate that substantially duplicates the primary material.
- Triumph-Adler AG (TA) recently solved the essential problem of having its product returned for recycling by selling their typewriter ribbon cassettes in eco-boxes. The customer sends the cassettes containing the used ribbon back to the company which then, using the regrainules, produces casing parts. In 1991, the TA recycling center took in about 94,000 returned

cassettes, one year later the number was 160,000, and in 1993 a total of 212,000 had been received.

- In its production of semifinished products and equipment parts made from polyamides, Huettig GmbH in Camburg, Thuringen, avoids waste and the need for recycling. Form casting, spray casting, and special extruded profiles keep the amount of waste to a minimum. Rather than returning left overs to the production cycle, they are depolymerized into lactam, the raw material for nylon fiber.
- Since the beginning of the year, Regra GmbH in Primasens-Gerbach has also been practicing chemical recycling that is very close to material-specific recycling. The company has invested DM1.7 million in Germany's first ever plant for the recycling of PUR shoe sole waste. The 70 tons of the company's own production wastes, valued at DM400,000, no longer land in a waste dump. Moreover, the high capacity of the plant opens up recycling jobs to other PUR workers. In the recycling process, the waste plus polyalcohol is restructured into a dispersion at 200° Celsius. Naturally, a specific PUR formulation is required.
- BASF Schwarzheide GmbH has successfully tested a glycolysis for recycling mixed PUR foams as, for example, those from automobile seats. For some time now, the production left overs of an automobile supplier have been processed using this technique.

Recycling can become the driving force in economic development. With a market share of 19.8%, as against the United States' 16.7% and Japan's 13.0%, Germany leads the world market in products protecting the environment.

German Process Decontaminates Swedish Reactor Vessel

MI1905080094 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
25 Mar 94 p 21

[Text] The CORD [chemical oxidation reduction decontamination] process has successfully been used to decontaminate a nuclear power station reactor pressure vessel for the first time in the world. CORD, which was developed by the power generation (KWU) division of Siemens AG, has thus proved its efficacy in this field as well.

In addition to the reactor pressure vessel, all four circulation loops and the reactor water purification and residual heat removal system in the Swedish Oskarshamn 1 nuclear power station (442 megawatts) were decontaminated in 13 days. The test results available to date show that well over 99.6 percent of the radioactivity was flushed out, in other words that the average decontamination factor was much greater than 200.

This process makes it possible to convert all the chemicals involved into carbon dioxide and water without residue, even while the decontamination work is still under way. On completion of decontamination, therefore, the water reacquires demineralized water quality. The dissolved cations and radioactivity have been removed by the ion exchanger filter in the reactor water

purification system, thus requiring no additional ion exchanger. Once the reactor pressure vessel had been hosed out with high-pressure water, it showed only a "residual wipe-off activity" of about 4 Bq/sq.cm. The dose rate at the bottom of the vessel was lowered by more than 20 mSv/h to under 0.02 mSv/h, and this extremely low radiation level now makes it possible to carry out the relevant tests and repair work.

Following the positive results obtained with CORD, Siemens-KWU has been commissioned to undertake a similar job in Finland, where the 300-cu.m primary system of the Lovisa nuclear power station is scheduled for decontamination in August 1994.

Germany-Saudi Arabia: Joint Research Project to Produce Hydrogen From Solar Energy Reported

94WS0353A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 9 May 94 p 10

[“German-Saudi Arabian Research Project ‘Hysolar’ Reports First Success”]

[Text] Stuttgart—The German-Saudi Arabian research project “Hysolar” has reported its first success. For the first time ever, in the Arabian desert, 40 kilometers northwest of the Saudi capital Riyadh, hydrogen has been produced technically in a procedure involving the direct coupling of solar power generation and the electrolysis of water. Researchers from the German Aerospace Research Institute (DLR) have been working on this project since 1986 at Stuttgart University with their Saudi colleagues from the King Abdulaziz City of Science and Technology (KACST) in Riyadh and the universities in Jeddah, Riyadh, and Dhahran.

Gerd Eisenbeiss of the DLR, chairman of the German steering committee, called the start-up of the solar cell-powered, 350-kilowatt-electrolysis plant in KACST’s Solar Village a milestone. Eisenbeiss describes the accomplishment as follows: “The production of storable and transportable hydrogen is proof that a scenario incorporating solar power imports from the Sun belts of North Africa and Arabia is technically possible.”

Studies relating to “Hysolar” prove that the hydrogen in future power supply systems having a highly regenerative power share can increase supply reliability. To be sure, the researchers admit frankly that solar hydrogen will only become economically attractive when the solar electricity required for the electrolysis process can be obtained substantially cheaper than it is today by means of photovoltaics and solar power plants, which utilize the concentrated sunlight thermally.

Eisenbeiss notes further that in order to optimize the entire system and to further develop the electrolysis technology, more work is needed. Unfortunately, financial support for the project is only assured until the end of 1995. Additional investments must follow after the DM76 million already granted. To this point, “Hysolar” has been financed half by

Germany and half by Saudi Arabia. On the German side, the Federal Ministry for Research and Technology and the Baden Wuerttemberg Ministry for Science and Research share the costs. On the basis of the system’s present still unsatisfactory 5% efficiency level, Saudi Arabia’s “solar resources” could, were solar power utilized ideally on only 1% of its land surface, deliver the same amount of energy that is currently exported yearly as petroleum. The researchers are certain that in several years more advanced photovoltaic electrolysis plants could reach an average efficiency level of 10%. “But,” Eisenbeiss concludes, “we shall never reach a price of five pfennigs a kilowatt as is the case for natural gas.”

France: Strasbourg & Lyons Laboratories Develop ‘Cage Molecules’

94WS0285B Paris L’USINE NOUVELLE in French
17 Mar 94 p 43

[Article by Jean-Michel Meyer: “Toxic Waste: Cannibalistic Supermolecules”]

[Text] Supermolecular chemical laboratories are creating “cage molecules” capable of recognizing and capturing toxic atoms or molecules. They can help reduce the volume of dangerous waste products.

Is antipollution technology going to be revolutionized by microscopically small creations? Within the space of only a few weeks, two supermolecular chemical laboratories, in Strasbourg and Lyons, have produced several decagrams of two types of “cage molecules,” veritable “chemical prisons”!

Their respective shapes (a “cup” for the calycinals, a “Chinese hat” for the cryptophanes) express their mission: to recognize and trap certain toxic atoms or molecules in made-to-order cavities. A reversible process: Once separated from other less harmful waste products, the trapped molecules may be released for processing.

High Precision

The highly selective molecular traps are in greatest demand by the nuclear and chemical industries. Calycinals attract atoms of cesium-135 and cesium-137 into their cavity, while the cryptophanes trap hydrocarbon and chlorofluorocarbon (CFC) molecules.

“A world first,” says Professor Alain Collet, head of the stereochemistry and molecular interaction laboratory at the Ecole Normale Supérieure, in Lyons. Manufactured from the vanillin molecule, the fifty-some-odd members of the cryptophane family already come in a variety of sizes. But this is the first time any laboratory has synthesized cryptophanes able to capture highly volatile molecules of very small size.

Work on this scale must be ultra-precise: The cage molecule, whose volume is 160 to 180 cubic angstroms, must capture a methane molecule whose volume is only 28 cubic angstroms! Identical results have been obtained

with ethane and propane. Also with two CFCs, freon-12 and freon-22, "but less efficiently," says Andre Collet.

Meanwhile, three researchers with the Laboratory of Analytic and Mineral Chemistry, a unit associated with the CNRS [National Scientific Research Center] and Strasbourg's European Advanced Chemical Industries College, have developed a gamut of calycinals that can extract 99.9 percent of the cesium from a solution. The results were obtained as part of the "Spin" (separation-incineration) program under the direction of the Atomic Energy Commission's Cadarache Research Center, in partnership with five European universities. "The calycinals behave like chemical clamps," explains Jean-Yves Barre, the Commission's fuel cycle director. And with formidable efficiency: The molecule can pick out one cesium atom from 45,000 sodium atoms in an acidic decontamination solution!

Shrinking the Volume

The objective: "To reduce the volume of slow-decaying waste, in order to cut the storage volume by a factor of three or four," he explains. Extracting the irradiated fuel from fission products such as cesium-137 and cesium-135 (which have radioactive lives of 30 and 2,300,000 years respectively) and the minor actinides (americium, neptunium, etc.) would remove some of the current constraints on storage of radioactive waste. Once purged of the most highly radioactive elements, nuclear waste could be stored on the surface instead of buried deep underground. But that is 10 or 15 years into the future. That's how long it will take for fabrication of calycinals to get from the laboratory to commercial production.

Already, however, the Electrochemistry Laboratory at the University of Rennes has made an important advance in treatment of primary circuit effluents at nuclear generating stations. Using electrochemical techniques, researchers there have synthesized ion-transporting polyether resins attached to carbon molecules, to trap radioactive ions (silver of atomic weight 110, cobalt-60, cesium-137, and potassium-40) in water solution at concentrations lower than 1 microgram per liter. Larger-scale tests of this technology are under way at the EDF [French Power Company] research center at Tricastin.

Initial successes in applying supermolecular chemistry to the antipollution domain are promising. In Strasbourg, efforts are under way to synthesize new calycinals to capture other radioactive elements (americium, etc.). And still other calycinals to imprison aromatic molecules (benzene, methylbenzene). These could be used to purify water or organic solvents by removing aromatic nuclei.

In Lyons, researchers are designing complex structures "that will not only recognize and capture but also transform," explains Alain Collet. By inducing catalysis, these new cage molecules should make it possible to transform methane into methanol, which is much more easily transportable.

But the industrial future of the cryptophanes rests on their potential as "captors." Elf hopes to employ them in systems to detect leakage of natural gas and other hydrocarbons.

Italy: Vegetable Diesel Oil Used For Vehicles, Heating Systems

MI1404102194 Milan *ITALIA OGGI* in Italian
8 Mar 94 p 24

[Article by Edoardo Cagnazzi: "Vegetable Diesel Oil, Biopalma, Is Here"]

[Text] Naples—Clean, sulfur-free fuel that is extracted entirely from plants and is made of soya, rape, and sunflower oil. For the time being this is almost a pioneer initiative but it opens up a new frontier in the production of a vegetable diesel oil, which is an alternative to diesel oil, and also with a more acceptable performance in terms of heating and urban pollution. The sophisticated technology for the production of Biopalma, which is the name under which the diesel oil produced from vegetable oils will be marketed, is a project of the Palma distillery. A company that is part of the Neopolitan agroindustrial and biochemical Palma company with annual revenues of 550 billion Italian lire. Its holding company, Palfin, controls four sectors of activity. Distillation, with plants in Campania (Palma company), Puglia (Trani), and Sicily (Vinum Marsala and Trapas Trapani). The plants of Bari Palolio and Palvino operate in the oil sector; Chirico and Campano in the food sector. Finally the sole biotechnology plant is located in Calitri.

The fuel, say its producers, will revolutionize the fuel market within the coming years because it does not contain sulfur, the major cause of acid rain. This fuel was inserted in the Ruffolo-Conte decree two years ago to prevent pollution in urban areas and is currently being tested by several transport companies (AIM and Vicenza, AMT Trieste, ACAP Padua, ATM Milan, SEPSA Naples, and others). Since Biopalma is obtained from renewable sources it does not impoverish natural resources and drastically reduces polluting emissions from both heating systems and vehicles.

Netherlands: Largest Solar Energy Project To Start in Amsterdam in 1995

BR2004141494 Amsterdam *POLYTECHNISCH WEEKBLAD* in Dutch 14 Jan 94 p 3

[Unattributed article: "Amsterdam To Have Europe's Largest Solar Energy Project"]

[Text] Amsterdam—By next year Amsterdam will have the largest public housing solar energy project in Europe. Commissioned by the Amsterdam Energy Company [EBA], 66 homes in the district of Nieuw-Sloten are to be provided with photovoltaic cell systems. Danish, Italian and Spanish partners are following the progress of this large-scale, European Community demonstration project with great interest.

The recent promise of financial support from the European Community and Novem (Netherlands Organization for Energy and the Environment) has helped the Amsterdam project a great deal along. "Certainly because it concerns the first, large-scale project in Europe in which solar energy is wholly included in home architecture," says project leader J. Cace, of the management department of the EBA. She points out the fact that there will be no orange roof tiles on the roofs, but only dark blue solar boards. The total surface of the photovoltaic cell systems is 2,500 square meters, and the capacity of the solar cells is 250 kW. The foundations for the project will be laid in September of this year; the completion of the solar houses is planned for May 1995.

Public Network

Another striking part of the project is the fact that the electricity which will be produced will not go directly to the occupants of the houses but to the public network. Via the medium and low voltage network the current will go back to the district. "This way even houses that do not themselves contain solar cells will profit from the clean solar energy," says Cace. Through the use of solar energy, the inhabitants are able to reduce the amount of pollution in the atmosphere by 135 tons of CO₂, 300 kilograms of SO₂, and 376 kilograms of NO_x.

The solar cells are made by R&S Renewable Energy Systems in Helmond and BP Solar in Leatherhead (United Kingdom), each of which is responsible for half of the cost. In addition to the commissioner, EBA, Ecofys is also taking part in the project. The project has also drawn the attention of other EC countries, which have similar plans. Participants are the PV Applications Center in Newcastle, Sermasa from Madrid, Miljokontrollen of Copenhagen, and the Institute Cooperatieve per Innovazione in Genoa. Cace again: "Finally, it is an important demonstration project for Europe because it will, for instance, provide more insight into increases in scale, and the economic advantages of full integration of solar cells in the construction and power supply by district."

Elf Petroleum Creates Marine Pollution Research Center in Norway

94WS0290C Paris L'USINE NOUVELLE in French
24 Mar 94 p 47

[Article by Jean-Michel Meyer: "Elf Creates an Anti-Pollution Center"; first paragraph is L'USINE NOUVELLE introduction]

[Text] The group's Norwegian subsidiary houses its new laboratories to study marine hydrocarbon pollution and ways to combat it.

The 19 March inauguration in Norway of the Akvamiljo center to study marine hydrocarbon pollution was a watery one, marked by snow, rain, and hail showers. Built by Elf Petroleum Norge (EPN) at the mouth of the Boknafjord on the west coast, the center is only five kilometers from EPN's headquarters in Stavanger. The

center's mission, explains its assistant director Bertrand Gaudebert, is "to learn more about the risks of our industry's impact on marine environments, and to devise ways of cleaning up pollution and restoring sites."

Akvamiljo is the second research center, after its geophysics institute in London, that the petroleum group has established outside France. "We found the scientific marine environment expertise we needed in Norway," adds Bernard Gaudebert. EPN and Rogalandsforskning, Stavanger county's semi-public research institute, have signed a 10-year collaboration agreement that calls for the latter to supply nine of the 11 researchers that will work at Akvamiljo. The specialists will be drawn from the fields of chemistry, marine biology, zoophysiology, immunology, and microbiology.

Elf will pursue the EUREKA Bioren project to study hydrocarbon biodegradation—on which it has been laboring for several years—in Norway. The program is underwritten by EPN, Elf France, the French Petroleum Institute, and Rogalandsforskning. Bioren aims to refine our knowledge of the mechanisms involved in hydrocarbon biodegradation, and to improve the effectiveness of biological treatments as a function of ocean conditions, the salt content of the water, the type of hydrocarbon pollution, and so on. It also seeks to model the effects of the additives used to biodegrade hydrocarbons, in keeping with the characteristics of the polluted site.

The bulk of the center's marine ecotoxicology work will consist of helping devise standard microtoxicology tests in conjunction with other European research laboratories. The tests will measure the impact of chemicals employed in offshore oil work on living organisms such as crustaceans, turbot larva, and algae.

To gauge the effects of marine pollution on animal and aquatic life, Akvamiljo researchers are putting together biosensors. The scientists' goal is to find a marker of past pollution "carried" by living organisms. Such a marker might consist of DNA damage or fish otoliths—that is, mineral stones of the calcium carbonate that is present naturally in living organisms. Powerful analytical tools such as laser or electron-scanning microscopes could then be used to detect heavy metals or other substances that had accumulated in the stones.

Improved techniques to clean up drilling refuse aim to extract the hydrocarbons in drillings and oil sludge (introduced through the drag bit, they do not dissolve salts and thus prevent the formation of cavities in the rock). An extraction and cleanup process using supercritical CO₂ is under study. The technique will enable oil companies to send drilling waste from which all traces of hydrocarbons have been removed to the bottom of the ocean.

The center's final goal is the development of technologies—notably techniques to prevent accidental spills—to combat hydrocarbon pollution. Specific sensors acting as sentinels in the buoys of offshore or port areas could be used to detect abnormally high hydrocarbon rates.

Studies with the Group's Ocean-Drilling Subsidiaries

The Akvamiljo center, which is wholly financed by the oil group's Norwegian subsidiary at a cost of Fr32 million, is open to any Elf entity. It will conduct joint studies with the southwestern laboratories; with Atochem's fresh water research center and its subsidiary Ceca, which has developed a nutrient that speeds up the biodegradation of hydrocarbons; and with any Elf subsidiary that drills at sea, from Norway to Guinea, Angola, or Gabon.

Elf Akvamiljo's Facilities

The center's 11 researchers work in 4 research laboratories that occupy 1,700 square meters of buildings housing sophisticated equipment.

The chemical analysis lab, for instance, can measure infinitesimal traces of pollutants in tissue through the combined use of gas or liquid chromatography and mass spectrometry.

The center also boasts a fermentation and microbiology laboratory with classic tools such as autoclaves, etc. It allows researchers to work in a controlled atmosphere.

Finally, the ecotoxicology lab can recreate cold, tropical, or warm atmospheres. It includes an experimental building for reproducing various marine conditions such as tides, rocky or sandy beaches, and so on. The water required for research is drawn from the fjord at a depth of 80 meters and a rate of 12 cubic meters an hour. After use, it is treated in a wastewater station and returned to sea.

Akvamiljo has an operating budget of Fr16 million a year.

Biodegradation Know-How That Works

Name: Inipol EAP 22.

Creator: Ceca (Elf group)

Feat of arms: made it possible to speed up the natural breakdown of hydrocarbons (bioremediation) spilled on Alaskan beaches following the wreck of the Exxon Valdez in 1989. Inipol EAP 22 is a nitrogen and phosphorus nutrient that stimulates the growth of many microorganisms in the marine environment which are capable of breaking down hydrocarbons.

EU Sponsors Research In Fuel Cell Reformer Components

BR2904105094 Zellik *TECHNIVISIE* in Dutch
Apr 94 p 30

[Unattributed article: "Fuel Cells: European Project"]

[Text] The European Union has awarded a significant subsidy to the Netherlands Gas Laboratory to examine, in cooperation with other European companies, the possibility of improving the "reformer," the essential element for the operation of fuel cells. The reformer enables

methane to be converted into hydrogen. The goal would be to create a reformer which is smaller, more efficient, more esthetic, and cheaper, and which kicks off faster.

A number of industrial partners are interested in the project. The ultimate goal is that Europe would have at its disposal an ultramodern technique in the field of fuel cells so as to strengthen its competitive position in a market where the Japanese and Americans have made great strides. The real project started in December and will continue for three and a half years.

FACTORY AUTOMATION, ROBOTICS

German Developments in Microengineering Outlined

94WS0311A *Duesseldorf VDI NACHRICHTEN*
in German No 14, 8 Apr 94 p 3

[Article: "Major Opportunities for Tiny Structures"; Subhead: "Micro- and Nano-Structure Engineering: Fantastic Innovations on Prototype Scale"]

[Text] Mainz, 8 April 1994—Micro- and nano-structure engineering is calling attention to itself with fantastic innovations on the prototype scale that will in fact decisively alter our technical environment and even the quality of our lives in a few years. New growth markets are beginning to develop for micro-structure products and industrial nations are preparing for a new technology race with support programs measuring in the billions. In the following article, professor Wolfgang Ehrfeld of the Institute for Microengineering [IMM] in Freiburg, describes the current situation.

Critical functional elements of modern engineering are growing increasingly smaller, attaining molecular dimensions, and at present it is even possible to manipulate individual atoms. Concurrently, the level of integration is increasing. In microprocessors and memory chips many millions of transistors are combined on a single tiny silicon chip and the billion-threshold, the gigabit chip, no longer appears to be so far removed. Together, miniaturization and integration are the engine for engineering progress. Micro- and nano-structure engineering is becoming the basis of our future security.

Internationally, microsystems that combine micromechanical, microoptical, microacoustic, microthermal and other microfunctional elements with microelectronics, constitute the technological basis for modern products. There are markets for microstructural products everywhere: automation, information and communications engineering, automotive engineering, aerospace, chemical process engineering and entertainment electronics deserve mention here along with medicine and bioengineering.

Research is still unambiguously uppermost in the case of nanostructures, thinking here of molecular storage

devices or so-called "quantum devices." When considering films of a few layers of molecules or atoms, however, that are decisive for the operations of many chemical and biological sensors, for optoelectronic components or for diverse, technically relevant interface phenomena, then nanoengineering—quite apart from the scanning tunnel microscope and its various derivatives—is already a significant economic factor.

The technological basis for the manufacture of microstructural products developed from semiconductor engineering, precision mechanics and optics. It is possible to produce high-precision three dimensional microstructures using anisotropic etching of single-crystal materials, dry etching processes with low-pressure plasmas, with electron, ion and laser beams or using depth lithography with X-ray beams. It is possible, using casting, stamping, electroplating or other shaping processes, to replicate such microstructures, if necessary, with nanometer precision, over and over again and to transfer them into other materials.

The compact disk [CD] is an example of the success of this type of replication design, wherein semiconductor micro-lithography, thin-film engineering and ultra-precision injection molding are in synergy. Using lithography, electroforming, casting [LIGA] engineering, developed in Germany, based on a combination of depth lithography, electroforming and shaping, the two-dimensional CD replication process is extended into the third dimension of microstructure engineering and an inconceivably broad diversity of products is developed, as demonstrated by the IMM in Mainz at the research and technology innovation market of the Hannover fair on the basis of microsensors, micromotors, microoptical systems, etc.

The extensive menu of microsystems engineering is exemplified through many other examples: Friedrich-Schiller university in Jena is displaying as a microsystem optical chips for laser doppler anemometry and magnetic sensors based on squids for accurate administration of ion rays in tumor therapy; Hamburg-Harburg technological university [TU] is presenting chemical gas sensors; and Bayreuth university is displaying the effectiveness of nanotechnology by means of materials research using combined scanning power and friction microscopy.

Absent materials research, micro- and nano-structure engineering are inconceivable and in this case the innovation market demonstrates many new approaches. We may mention here: Mossbauer spectroscopy (Goettingen university); the use of RFQ accelerators (Frankfurt university); high-resolution computer tomography (federal department for materials research); time-resolution materials research using the emissions electron microscope (Mainz university); analysis of extremely thin films using the Brewster angle microscope (Goettingen NFT GmbH) and differential reflectometry (Vilseck ATZ).

To be sure, this is only a tiny portion of the broad technological basis for micro- and nano-structure engineering. But it is one approach to engineering progress in

products, materials, testing processes, production engineering and applications in virtually all sectors of modern engineering.

Already in existence today as prototypes on the laboratory scale are: chemical analysis systems that are no larger than a sugar cube; micromotors that have been engineered together with ultrasound sensors and micro-mechanical instruments for vascular and neurosurgery in catheter systems having a one to two millimeter diameter; microsensor rays for the most diverse measurable quantities; and a multitude of micromechanical, microoptical or fluid engineering components. Using modern production methods of microengineering it is possible to produce various inexpensive connections for monomode glass fibers for optical data transfer with submicrometer precision and integrated switch or multiplex functions as well and photonics microcomponents are being developed for optical computers.

As fantastic as such applications may seem at present, it is also equally certain that in the foreseeable future our daily lives will be inconceivable without them. Still, microsystems for medicine, the new energy-saving injection system, that can be realized only with microengineering methods, the microsensors in tennis rackets or in the safety bindings of skis and many other micro-, and in the future, nano-structure products, can be produced inexpensively only if there are professional production equipment, product-specific materials, semi-finished products and fabricated products, design tools and a plethora of services in the hardware and software sectors and, of course, also in marketing and sales.

The federal ministry for research and technology has already allocated 400 million German marks [DM] for the support of microengineering and another 600 million is supposed to be forthcoming in the follow-on program, as the minister for research reported in February. Combined projects, in which a number of firms and research facilities are each participating, are foremost in this context and are supposed to accelerate progress through cooperation and a division of labor.

Compared to the outlays by other industrial nations or the total amount that the European Union [EU] plans to allocate to microsystems engineering in the fourth framework program, a support volume of a total DM1 billion is very significant. But even in the U.S. and the Far East, the key function of micro- and nano-structure engineering has been acknowledged for a long time and they have developed their own strategies for success. It is not just the amount of the support total, but rather the strategic approach that is decisive in a broad spectrum technology in which producers of microstructural products have to cooperate closely with their users as well as suppliers of production equipment, materials manufacturers and special services firms.

In microengineering, both Japan as well as the U.S. have demonstrated that they have better concepts of cooperation and innovation than Germany or Europe. Still,

international technological competition in micro- and nano-structure engineering has just begun. A visit to the research and technology innovation market and an exchange of ideas with the exhibitors may contribute to progress through cooperation in a key technology.

German Market in Automation Technology Viewed

94WS0319B Duesseldorf *HANDELSBLATT* in German
13 Apr 94 p B6

[Unattributed article: "Demand for Lean Production in Assembly and Handling Technology"]

[Text] Assembly and handling are, also from a business standpoint, important components of all manufacturing. During production, parts and tools must be available at the right time and at the right machine. Flexibly automated solutions for all requirements are helpful with this.

The integration of sensors, electronics, image and data processing in assembly and handling technology leads to cost reduction even for small lots. Lean production here as well. That does not, however, mean simpler or trimmed-down technology, but rather more automation, more flexibility, yet in less complex and thus more easily comprehensible units.

Demands for shorter cycle times, greater reliability and availability, greater precision with consistent quality and lower costs can for the most part only be met with automated assembly and handling. [Working conditions which] take their toll on workers' health, such as heavy, noisy, monotonous activities, can be minimized or eliminated entirely. Procedures carried out in extremely dangerous environments can, in fact, only be done with automation.

Automation in Assembly Becomes Increasingly Extensive

In 1992 the German assembly, handling and industrial robots (AHI) industry had sales of 3.9 billion German marks [DM] compared with DM4.1 billion in the previous year. In 1993, there was no impetus in either the domestic market or in exports, so a decline of 5 to 7% in sales is to be expected. Along with assembly technology and handling technology—including industrial robots—standard components and peripherals for systems technology are also part of the AHI industry. "We estimate the 1992 sales for this group at DM1.1 billion," says Dr. Ing. Heinz Muno, director of the Assembly, Handling, Industrial Robots (AHI) trade association in Frankfurt am Main. This corresponds to a 26%-share of the industry's total sales. Standard components and peripherals round out assembly and handling equipment as complete systems.

Assembly technology and handling technology each received about DM1.4 billion, or 37% apiece. A shift in this share is becoming apparent for 1993. Continued

development of sensor technology and control and process control technology is making automation of complex assembly processes progressively easier. The proportion of business done in assembly technology and standard components and peripherals is increasing correspondingly, while handling technology has already reached a high level of automation.

The export quota for the approximately 200 mostly mid-sized companies in the German industry averages 35%. The importance of the countries of the European Community as trade partners for these companies can be illustrated with the example of industrial robots. For 1992, exports came to 181 million German marks, 75% of which remained within the internal market. Belgium, Luxembourg and Italy were in first place as buyer countries with 18% each, followed by France at 15%.

Machine building is gradually rebounding from the depths of the recession. The assembly and handling technology companies are providers and outfitters for the entire industry. Because of this, however, they are also dependent on the economic situation of their buyers. The difficult worldwide economic situation correspondingly affects foreign as well as domestic demand in this field of automation.

Important consumer areas such as machine building and the automobile and the electronics industries have for some time been experiencing substantial setbacks in incoming orders. For German machine building, for example, talk is of the deepest recession in the last 40 years. The initially normal cyclical slowdown in the economy has become aggravated by the fact that since 1992 all other industrial nations—and thus trading partners—have also found themselves in a tailspin. Yet the beginning of the decline in economic activity was certainly variable in the individual countries: first the symptoms of weakening in Great Britain, Scandinavia and the United States; then Germany's drop, and finally the dramatic decline in Japan.

In 1993, the demand for machines in West Europe as a whole declined about 8%. That, however, only resulted in a loss of 5% for production, since exports to North and Latin America, Asia and East Europe as well have gone up. Because of the great importance of the internal market as a sales arena for European companies, the increase in exports to countries outside the Community cannot compensate for the weak demand in the home market. Some European countries have, however, already reached the bottom of the recession, while others are already even able to record a growth in machine production. Among these are the Scandinavian countries (with the exception of Denmark), Great Britain, Ireland and Italy.

Exports and thereby—at long last—machine production, especially in Italy, are profiting from the [currency] devaluations in the course of last year's turbulent monetary conditions. Low interest and pressures to modernize and streamline could also contribute some

impetus. German machine production can assume for 1994 a mild revival of output of 2% in real terms. This is supported substantially by overseas exports. The West European demand for machines will probably stagnate.

Machine Production Will Emerge from the Recession in Better Shape

The same is true for domestic demand to the extent that it is not dependent on exports. The cyclical fluctuations in the economic situation could be surmounted by 1995 and 1996. Machine production might count among the winners, not least because many companies are using the recession to restructure. They will emerge from this process in stronger condition.

The companies of the AHI industry stand by their customers as reliable partners in automation with innovative and customer-specific solutions and appropriate service provisions. "Module technology" permits flexible planning of production and simple reorganization—a contribution to the competitiveness of the buyers. German machine production has forged for itself a leading roll in international competition with its top level accomplishments in technology. More than 20% of the exports worldwide come from Germany with about 15% each from the USA and Japan.

German machine production also has to thank for its position its subcontractors and suppliers who for their part provide high-tech products. The newest developments in the automation of assembly and handling processes as well as an overview of the international state of technology are being offered by the more than 200 exhibitors at the approximately 13,000 m² exhibition area of the Assembly, Handling, Industrial Robot Trade Show being held in conjunction with the Hannover Trade Show from 20 to 27 April 1994.

Running parallel to this, the 25th International Symposium on Industrial Robots is taking place from 25 to 27 April. Practical examples will illustrate diverse and efficiency-increasing possibilities for using industrial robots. In addition to assembly and handling technology, themes include robot components, control systems, image processing, surface technology, welding, bonding, and new areas of applications such as service robotics.

Expert on Strategy of German Machine Tool Industry

94WS0334A Duesseldorf *HANDELSBLATT* in German 27 Apr 94 p 23

[Article by HSN, Duesseldorf correspondent: "Machine Manufacturers Must Learn Orientation to Customers' Needs"]

[Text] Duesseldorf—The German machine tool manufacturers are now undergoing a reorientation process. They have to develop machines with fewer technical extra features and for a lower price. *HANDELSBLATT* talked with Prof Tilo Pfeifer, business managing director of

Werkzeugmaschinenlabor [Machine Tool Labor] (WZL) in Aachen about the technical consequences.

The machine tool industry is still essential to machine and plant building, because every type of production is based on use of machine tools. Germany was always leader in this field and, according to Pfeifer, "has actually not more than to a marginal degree relinquished its position to its chief competitor Japan."

The medium-size machine tool manufacturers were particularly hard hit by the decreasing demand for capital goods. They had specialized in machine tools high-tech fabrication processes, the first ones factories struck from their purchase lists for reasons of the high cost. The crisis in machine tool manufacturing is not a problem faced by this industry particularly but rather a major a consequence of overproduction in all sectors of industry "affecting any enterprise when the demand decreases and competition on the market becomes ever keener," says Pfeifer.

Machines Too Expensive in Times of Cash Shortage

While competing with the Japanese, the machine tool manufacturers have in the past let themselves be pushed too hard into the specialty niche and left the mass market to the Japanese. However, also the Japanese had to realize now that in an economic crisis it is not any more the volume they can count upon to ensure cost-effective production. These machine tool manufacturing enterprises, like all others, now need more flexibility in order to more quickly respond to market fluctuations.

In order to find a way out of the crisis, it is especially the German machine tool manufacturers who must learn to orient their products to customers' needs. "This is a very important prerequisite for as soon as possible regaining a foothold on the market," says Pfeifer. Most enterprises do not understand that this is also a significant aspect of quality management, a strategy much talked about but implemented by only a few enterprises.

"Furthermore, our abilities and creativity have pushed us too far in targeting many branches of industry and made us build into the machine tools features which, while nice and attractive, are of no use to the customer," says Pfeifer in a mood of self-criticism. Now, when money for investments is scarce, the customer wants only what can be cost effectively utilized. The machine tool must be as robust as possible and allow for future additions.

Integrated Fabricating Operations Not Flexible Enough

During the second half of the 1980's German manufacturers had more heavily emphasized integrating the operations, with the machine tool a component of a computer-controlled system. At that time they were convinced that such systems, which a computer can fully automate through all stages from planning to production, will perform better and respond faster to demand

fluctuation. "However, this was an illusion," Pfeifer deduces from what he now knows.

The trend is now back to autonomous units. In this way individual production stages acquire more independence. "This does not, however, mean a return to manual labor," explains Pfeifer. Rather, this should eventually make possible relatively quick on-site modification of part programs without prior involvement of lengthy planning procedures. The organization of these autonomous units will then be controlled not from a higher-echelon center but by a self-regulating mechanism. In connection with this one is considering chaos organization and cooperating fractals. Various catch phrases have already been coined, essentially referring to similar concepts of autonomous production units.

One of the key development regarded by Pfeifer as a future-oriented one is, therefore, an autonomous production cell: a machine tool which makes efficiently performed functions in the production process available to the human operator. In this way the attendant who programs the machine tool should have available an integrated computer technology which requires only that the configuration of machine tool components necessary for machining blank parts be entered. "The whole task of assigning operations to cutters and planning the procedure is automatically performed by processors and controls in the background behind the machine tool."

A production cell is moreover equipped to perform a broad range of monitoring functions: first of all ascertaining that all necessary functions are properly included, then inspecting and monitoring the tools, and finally monitoring the machining process. Many new measuring operations are integrated into machine tool for this purpose.

The third level of functions to be added concerns the machining itself. The aim is to meet the demand that a machine tool can be set up so that both turning and milling can be done at the same time rather than only classical turning at time, this having already been proved to be feasible in several cases. As the next interesting feature will be considered combination of turning, milling, and drilling in a single setup. Says Pfeifer: "I think this will be a further evolving process which will indicate how many classical machining operations can be rationally combined."

More Functions Integrated in One Machine Tool

Beyond that efforts will be made to integrate new technologies such as, for instance, laser machining into the machine tool. "This idea is not entirely new idea," Pfeifer admits, "but still in an early development stage." In this way it will become possible to process parts made of hard materials by first heating them with a laser beam and then machining them while they are hot.

Development of future machine tools could lead to a more far-reaching than before collaboration with the user industries, says Pfeifer: "Colleges could take over

the development work for future machine designs, work which at this time individual medium-size enterprises can financially not afford to do." The advantage would be that those enterprises could then integrate the innovations into their own products on a step-by-step basis without impairing their competitiveness.

German Research Produces User-Friendly Machine Tools

94WS0346A Duesseldorf WIRTSCHAFTSWOCHE
in German 29 Apr 94 pp 94-97

[Article by Burkhard Bönkel under the rubric "Machine Building and New Materials. Special. High-Tech": "Machines of the Future. Closer Man-Machine Contact. German Manufacturers for Years Developed Machines As Their Customers Stood By Watching. Now for the First Time the Units Are Operator-Friendly and No Longer Shut Out the Know-How of Skilled Operators"]

[Excerpts] [passage omitted] On the broader front research institutes and companies have set about long overdue radical changes:

- Intuitive input and programming by means of graphic symbols, voice and gestures. Aspect GmbH in Norderstedt has developed voice recognition for a limited number of machine commands. Siemens researchers recently introduced an image processing system in which a hand gesture is sufficient to control the machine interfaced to the system.
- Process control and monitoring. From now on operators will be able to be informed directly on the machine's screen about every situation, invoke auxiliary functions and intervene in the computer-controlled process. Grundig Gildemeister Automation GmbH in Hannover has integrated into the control system the operator's manual, that up to now has been on paper, so that the operator can consult it at the scene of the action.
- Planning. Via internetworking with production planning, the machine operator already in the near future will be able to decide totally on his own when and in which order he wants to make individual parts.

Not that the industry's mighty have accelerated the progress of the change, but former outsiders like Oberhager Autocon GmbH, R&D Steuerung und Datentechnik [Control and Data Systems Technology] GmbH in Möchengladbach, R. & S. Keller GmbH in Wuppertal, Augustin & Partner GmbH in Neubrandenburg, and IG Metall [Industrial Trade Union of Metal Workers].

It starts with seemingly trivial changes that reactivate the operator's senses: For instance, in R. & S. Keller's control system the screen and operator's panel are to be moved so that the operator always has the monitor and machining process simultaneously in his field of view. Or that the operator, in spite of complete enclosing, can listen into the machines in order to monitor acoustically the machining process. Sensors and headphones suited

for this purpose have been developed at the Kassel cluster college's Institute for Ergonomics.

Then the operator's closer contact with the machine brings about, with revolutionary simple programming and control systems, a decisive jump in productivity—for instance, via Keller's GKE/CAM or Autocon's Autowop M, that the operator can operate in the shop, as well as control systems that enable intervention in automatic operations.

Up to now programs for machines have had to be written with cryptic-appearing commands like G0, L100 or M30. Because each control system producer has its own dialect, the mastery of a single type of control system really represents a truly Herculean task. "It is almost impossible for a single operator to be able to operate several machines at the same time," complains Herbert Schulz, head of the Institute for Manufacturing Technology and Machine Tools at Darmstadt Technical College. The consequence: Programs are being created in production planning and not by the operator in the shop. "New factory models with team work and fractal structures are accordingly from the outset doomed to failure," Werner Bauer, manager of the European Federation of Fractal Enterprises GmbH in Nuremberg, says knowingly.

However, Keller and Autocon make do without a program code line: For instance, if the operator wants to turn a taper by means of GKE/CAM, he chooses the proper graphic symbol from a menu and enters the coordinates and machine data. Before the machine sets to work, the operator can view the part in three dimensions on the screen and run through a simulation of the machining process. Outstanding point: So-called post-processors knit together from these entries conventional programs for over 30 different types of control systems, and these programs can then be run online or from diskette. Keller, thinking ahead, is adding one other thing to its new CNCplus control system that is now coming on the market. Not just that programming on the machine is a cinch here, similar to GKE/CAM software. CNCplus weds the computer control system to two handwheels that are normally used to control conventional machines and are not present on any current CNC machine. A lathe or milling machine so equipped can now for the first time in the world be run manually, semiautomatically and fully automatically. Other manufacturers are slowly following suit: Grundig Gildmeister Automation has now introduced a control system that upgrades conventional machines to semiautomatic CNC machines.

The integration, now beginning, of complex computer technology and manual operation is urgently necessary. In German companies CNC machines live in the shadows with a meager 15-percent share of the machine inventory. This is the operators' revenge: "Because one could hardly operate CNC machines, operators stuck with conventional machines," Autocon head Hannes W. Politsch says knowingly. This, says the former vice

president of Deckel, "is a considerable productivity disadvantage for the base of Germany vis-a-vis Japan and the U.S."

User-friendly machines will gain in importance even more in the future. Further improved performance is to be expected in every type of machine, with high-speed machining, greater precision and the use of new materials. On paper anyway. Autocon head Politsch says, urging haste, "If a revolution does not occur now at the man-machine interface, the advantages will be theoretical."

Germany: Developments in Laser Machine Tools Noted

94WS0346B Duesseldorf WIRTSCHAFTSWOCHE
in German 29 Apr 94 pp 103-105

[Article by Andreas Gerlach under the rubric "Machine Building and New Materials": "Lasers. Urge for Light. German World Market Leaders Want to Strengthen Their Position With Higher Beam Power"]

[Excerpts] [[passage omitted] The laser is more and more developing into a wonder weapon in the struggle for international competitiveness. And technology for the future is one of the few areas in which the Germans are ahead technologically. "The Japanese are simply not up to date here," asserts Arnold Mayer, chief executive of Optech Consulting in Biesingen and one of the best authorities on the scene. Welding and three-dimensional cutting above all are provinces of the Germans. In these most important fields of application for CO₂ and solid-state lasers they profited strongly from the automobile industry's innovation drive during the 80's. Today there is hardly a single passenger car maker that does not cut, drill, mark or process with the aid of lasers.

Most recently small and medium-size companies have also been feeling the urge for light, especially in the electrical and electronics industry. Point-precision microsurgical intervention in integrated circuits is possible with lasers. Precision welding and soldering are also no problem for a light beam. Added to this is the flexibility of the tool, which enables the economical production of even small lots down to single pieces.

Still the marketing of laser machines is making no progress. "The high investment," says an industry observer, "is at the moment not possible for most companies." For better or worse, laser manufacturers are tied to the situation in the machine building industry, which is only slowly improving. For instance, the domestic demand for lasers last year dropped by 20 percent to 600 systems. Only exports saved the German laser industry from a nose dive. The dynamically growing U.S. market represented a substantial share of this.

Even Rofin Sinar Laser GmbH, world market leader in the manufacture of CO₂ lasers, is "distinctly in the red," admits chief executive Samuel Simonsson. After the

success of the 80's the Siemens subsidiary set its mind totally on expansion. Today part of the just recently developed site of a passenger car dealer is being used for a warehouse. "Our great expectations have not been fulfilled," Simonsson laments.

Now management is placing its hopes on a new development, the so-called diffusion-cooled CO₂ laser. In conventional systems large quantities of the gas have to be circulated because it gets hot. Part of the carbon dioxide is routinely removed in order to reduce the contaminants that originate in the process.

In the new development the gas is cooled as the laser light forms, so that the tremendous technical input for circulation is done away with. Because of this the new CO₂ laser is smaller and more flexible. Rofin Sinar is presenting at Metav in Duesseldorf—the metal machining show that starts on May 3—a model having a power of 2 kilowatts. The immediate objective is to double this.

Germany: New Series of Heavy-Duty Robots To Be Demonstrated

94P60226A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIR WIRTSCHAFT in German 12 Apr 94 p 8

[Text] Fanuc Robotics Deutschland GmbH (Bernhaeuser Str. 22, 73765 Neuhausen) wants to display a new series of six-axis heavy-duty robots at the Hannover Trade Fair. The S-420i robots have new controls integrated into the robot arm. The company claims this will save production space, which is needed for the usual control box, and will reduce wiring costs. The new robots are said to have better acceleration values and can reduce the cycle time by 20 percent. Moreover, further increase in availability is also achieved by reducing the number of parts, the company reports.

Sale, Use of Industrial Robots in France Viewed

94W50317A Paris INDUSTRIES ET TECHNIQUES in French Mar 94 p 56

[Article by Mirel Scherer: "Investment in Robotics Still Declining: Less than 1,000 Robots Installed in France in 1993"—first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Slightly fewer robots were installed last year. The installed base in France consists of 11,795 robots.

The number of robots installed in 1993 dropped by only 4 percent (974 compared with 1,013 in 1992). The total number of robots operating in France thus amounts to 11,795 units. This gave our fellow magazine ROBAUT and the French Industrial Robotics Association (AFRI) an opportunity to announce the first upbeat statistics published in a long time. With a warning note, however, because sales dropped considerably—by 20 percent—after manufacturers engaged

in a "fierce price and discount battle." Small to mid-size industries and firms continued to invest in these automation means, and 407 robots were installed in their plants in 1993. This is due to the sharp fall of robot prices (11 percent in 1993 alone).

When the automobile industry sneezes, robotics catches cold: the depressed market confirmed the saying. For the first time since these statistics are computed, automobile manufacturers and their subcontractors accounted for less than 50 percent of the market (only 46 percent). There is some hope, however. Several industries claim that they need more robots. The agrifood industry, for instance, with a 36-percent growth rate (by number of units), or the electric/electronics industry with +6 percent, or again the glass/ceramic industry which increased its purchases fourfold, from 7 to 29 units.

From a technical point of view, four-axis robots and robots with more than six axes were the most popular with users. The same was true of robots with Cartesian, spherical, and parallel axes. Over two thirds of the robots installed in 1993 handle loads weighing less than 60 kg. Parts handling, remains a major robot application, although it was hit hard. That was not the case of palletization and packaging, a sector which considerably increased its use of robots, while machine loading/unloading was far from achieving the same score as in 1992 (it declined by about 50 percent). The feeding of plastics injection-molding machines made a remarkable leap. On the other hand, welding (arc welding as well as spot welding) no longer pays: the number of robots installed is in marked decline. As for education and research, the number of robots they use increased threefold.

France: Snecma Automates, Integrates Design, Manufacturing Process

94W50350A Paris INDUSTRIES ET TECHNIQUES in French 2 Apr 94 p 61

[Article by Laurence Girard: "How Snecma Is Computerizing Its Methods Engineering Department"]

[Text] Its object is to improve the drawing up, management, and circulation of technical documentation. All stages of the engine parts manufacturing process will be described by the engineers at workstations. These descriptions will be added to a shared database. In due time, the workers will consult the workshop instructions on screens.

The Snecma aircraft-engine parts manufacturing "script" is handwritten by the methods engineering department's 160 engineers. It describes all the operations to be performed—machining, milling, stamping, etc.—at each stage of the manufacturing process, and is accompanied by schematics showing the evolution of the parts. This "movie" will soon be displayed on workstation screens. At any rate, this is one of the objectives of the Spirit project that is under way at Snecma's Corbeil site, which employs 4,400 persons, and whose main

activity is the fabrication of parts and subassemblies for civil and military aircraft engines.

This project, begun in 1990, is part of the steps being taken toward computerizing the methods engineering stages. Of the three stages involving considerable work by the methods engineers, the first and the last have already been computerized. The first consists of defining the major production steps of a new product line. This takes place prior to launching the manufacturing process. The second methods engineering stage converts each production step into workshop instructions addressed to the shopworkers. The third stage serves to define the list of tool setups and quality checks that are indispensable to the carrying out of each instruction. The major production steps and the tool lists are already available in the data base mode named Omega. Only the drawing up of the instructions is still essentially a manual operation.

These instructions represent a considerable volume of paper. Suffice it to imagine: Snecma's Corbeil site holds the reference documentation on 8,000 parts. This represents 8,000 manufacturing operations. And each operation can represent as many as 15 workshop instructions, each of which entails several pages of description. In all, a stack of over 500,000 pages! To boot, this documentation must be kept for some 30-odd years. "This keeping and updating of documents was being done very poorly," says Jean-Pierre Chavanon, who heads the Spirit project, the main objectives of which are to improve the traceability of the documents, reduce the cycles involved in the creating of production data, and avoid the problem of retrieval of documents.

For the moment, it is yet too early to know if these objectives will be fully attained. The project is still in midstream. After having "polished up" the document display formats so as to rule out deviations stemming from personalized touches, 1991 was the year of technical choices. Since two thirds of the documents consist of drawings, and one third of text, a tool had to be found to manipulate both. "We did not want to produce sophisticated documentation, but simply technical files. We had before us CAP (computer-assisted production) tools oriented mainly toward text and display, and CAD (computer-aided design) tools oriented more toward drafting." Finally, Jean-Pierre Chavanon chose CimLinc, a composite tool distributed in France by Intelligent Document. It provides CAP and CAD capabilities simultaneously. The application, based on CimLinc, is being developed in-house. "We are designing it, to the extent possible, with the engineers who will be using it, and we are trying to preserve their working methods," says Jean-Pierre Chavanon. Since the middle of last year, some 20 workstations have been installed, and 60 persons trained. By the end of next year, 60 workstations are expected to be available.

Spirit calls for each engineer to be equipped with a Sun workstation. He will retrieve the drawings created previously with Catia software, detail them, and annotate

them. The structure of the document will be automatically updated. He will then draw up the workshop instructions, remarks, etc. These instruction documents are not drafted in a single go. Several persons lend a hand. Some methods engineers are generalists; they are responsible for the part as a whole. But they call upon specialists—welding specialists, for example, specialists in surface treatment, and all other techniques—to fine-tune the document. As of now, these documents, on paper, circulate hand-to-hand among the engineers, with all the problems of updating and the responsibilities this procedure entails. With Spirit, each person, working at his or her workstation, will have access at all times to the document, which will be stored in the shared database. All modifications will be recorded together with the name of the specialist who has made the modification.

New manufacturing operations are already being carried out with this new system. The database will be added to progressively. Whatever is on paper will stay on paper, of course. The paper files and the division storerooms, which have the job of duplicating the documents and distributing them within the workshop, will still be around for some time to come, although the idea for the time being is to short-circuit the division storerooms progressively by distributing the documents that are still in paper form directly to the manufacturing stations. Under the new system, each shopworker will make a printout of the documents that are of interest to him or her, and in due time will perhaps access the screen directly for workshop instructions. This second phase of the project has been taken in hand by Snecma's Gennevilliers site. A natural course of events, given that Gennevilliers has decided to adopt what has already been achieved at the Corbeil site. There is no point in duplicating studies at a time when the aeronautical market is hurting badly. And the more so considering that the project as a whole is costing around 9 million French francs [Fr].

Snecma: 13,800 Persons, 6 Main Sites

Snecma's 1991 revenue totaled Fr14.5 billion, approximately 80 percent of which was generated by exports. Its 13,800 employees are distributed over six main sites. Its Gennevilliers site manufactures forged and cast parts. Its Evry-Corbeil center, equipped with 1,500 machines, manufactures civil and military aircraft engine parts and subassemblies. New engines are designed and tested at the Melun-Villaroche site. Snecma's highly automated Creusot plant produces the turbine disks. Elecma Suresnes houses Snecma's electronics division. And Snecma's Istres site is its flight test center.

France: Sextant Avionique To Use Just-in-Time Method in 1994

94WS0350E Paris L'USINE NOUVELLE in French
28 Apr 94 p 68

[Article by Stephane Farni: "Sextant Avionique Recovering Lost Time"]

[Text] *Running behind its competitors, Sextant Avionique is putting on an extra spurt to improve its flexibility.*

A general mobilization is under way at Sextant Avionique, Thomson's and Aerospatiale's specialized subsidiary. The just-in-time method of production, launched around the beginning of 1992 in a pilot workshop at its Bordeaux plant, will be generalized this year at the group's five main sites: Bourdeaux, Chatellerault, Valence, Velizy, and Vendome. With the aeronautics industry currently in a slump, the change will not be all that easy to manage. Sextant's revenue dropped 10 percent in 1993, to 4.9 billion French francs [Fr], versus Fr5.4 billion in 1992.

After getting off to a late start and trailing behind its American competitors, Sextant is bent on recovering lost time. For, looking beyond the current crisis, the pressure being exerted by clients, aircraft manufacturers, and airline companies, is mounting. Boeing and Airbus have both placed priorities on reducing production cycles. "Until now," says Francis Lefebvre, the company's industrial manager, "these cycles have been running on the order of around one year at Sextant. Today, our clients are demanding a normal turnaround time of one month. In other words, they are demanding that in the normal course of activity we be capable of modulating our production cycle within a maximum delivery time of one month."

During 1993, these external constraints were compounded by the instituting of a new organization. Five market-oriented divisions (civil avionics, military avionics, helicopter avionics and instruments, space, and automatic testing) have replaced the former product-oriented divisions. The company's industrial sites, which until then had been managed by a central industrial head office, have been placed under the new divisions. Velizy, for example, which manufactures all the flight computers, has taken over the civil avionics division. Bordeaux, which specializes in displays, has become the seat of the military avionics division. At the same time, each plant can become the supplier (or the client) of the others.

The introduction of the just-in-time method has followed a classic format. The first stage is the creation of individual product lines. At Velizy, the Airbus A 320 computer line began operating in February. Three others will follow: A 300-A 310 computers, A 330-A 340 computers, and military computers. Heretofore, these different products have been processed in a single workshop. The operation was made all the more complex by the existence of several types of computers for each model of Airbus (eight for the A 320), with a few hundred of each being produced each year (Sextant manufactures a total of 22,000 pieces of equipment and sensors per year). The system was identical at Bordeaux, with four lines of displays (the monitor screens that equip the cockpits), three for the Airbus, one for military planes. The second stage is the putting in place of the kanban system in the workshops. Sextant has contracted for the services of a specialist, Yves Milles, manager of the Gopal company, who for 10 years exercised

his talents in the workshops of the PSA [Peugeot Corporation]. His credo: There is no need to upset the manufacturing process in order for kanban to yield its results. The important thing is to not halt production because of a contingency. Hence the need to make the process fail-safe, whether that process be related to supplies, staff, or production capacity. Thus, Yves Milles has developed circular kanban panels that provide maximum visibility and display the status of manufacturing orders. "The more contingencies you have, the more interested you are in tying the flow of information to the physical flow of the process. That interest is what kanban is all about," he sums up.

The method was first tested at Bordeaux in a pilot plant that manufactures electric power supplies. The results speak for themselves with, among other things, a production cycle divided by eight. Kanban is now taking over at Sextant's other plants. At Velizy, on the A 320 computers line, the objective is to reduce the production cycle from nine months to three or four. "The books will reflect the economies beginning in 1995," says Francis Lefebvre. Something to look forward to while awaiting the recovery of the aeronautics market.

LASERS, SENSORS, OPTICS

UK: Luminous Silicon Developed for Optical Electronics

94WS0289C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Mar 94 p 8

[Article by BH: "Luminous Silicon From Airy Crystals"]

[Text] Frankfurt—By means of supercritical liquid extraction, British scientists have extracted a highly porous form of silicon which emits visible light. The aerocrystals are stable and should therefore be suitable as material for optical electronics.

Two years ago the group around Leigh Canham at DRA Malvern in Worcester (WR14 3PS, Great Britain) produced luminescent silicon crystals for the first time. At the time the researchers used an electrochemical etching method and obtained a porous material which consisted of 90-percent air.

In order to make the aerogels even lighter and improve their luminescent properties, the British scientists have now added another step to the procedure. The ethanol which remained in the pores of the porous silicon layers, obtained by means of an electrochemical process, was slowly replaced under pressure by adding liquid carbon dioxide.

With increasing pressure and higher temperature the pores in the silicon layer expanded and finally yielded an aerogel that consisted of more than 95-percent air. Until now the method of supercritical drying had been applied primarily in the production of porous ceramics, but not yet in silicon technology.

The airy silicon layers could, as their inventors write in the British scientific journal *NATURE* (vol 368, p 133), lead to dramatic improvements in the development of optoelectronic materials.

UK: Liquid Crystal Displays With Manganese Improve Properties

94WS0353B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 10 May 94 p 8

[Unattributed article: "Manganese Incorporated in Rod-Like Molecule Improves the Properties"]

[Text] Frankfurt—British chemists have succeeded in incorporating manganese in a rod-like molecule that has the properties of a liquid crystal. Reportedly, the technique can also be applied to other metals. Consequently, the *NEW SCIENTIST* reports (No. 1917, p. 18, 1994), in future a number of new liquid crystals could be created with interesting properties, as, for example, coloration.

The incorporation of metals in liquid crystals can improve their properties. The crystals, reportedly, become more stable because of their greater polarizability. Polarizability is the ability to change the electronic structure into electrical fields. In addition, displays incorporating such liquid crystals are more legible because the metals also alter the optical properties.

Since metals are prone toward coloration, liquid crystal displays of various colors could also be produced without the need of expensive color filters. Finally, the metals could also make the displays respond to magnetic and electrical switching, since almost all metals react to external magnetic fields.

Because of the special form a molecule must have to form a liquid crystal, it has so far only been possible to incorporate a handful of metals in liquid crystals. The molecule must be long and, above all, flat. But most metals prefer tetrahedron- or octahedron-structured environments. Only a very few, as, for example, platinum, nickel, and copper, accept planar structure.

Duncan Bruce and Xiao-Hua Liu of Sheffield University (Center of Molecular Materials, Department of Chemistry, Sheffield, UK S3 7HF) have succeeded in producing a molecule that contains octahedron-bound manganese. The metal atom is introduced somewhat to the side in about the middle of the long rod-like molecule so as not to disrupt the formation of a liquid crystalline phase.

The molecule is a particle in which the structural elements are linked together in a chain-like manner. There are long hydrocarbon groups at the ends; in the middle there are ester bonds and a so-called imino group by means of which the manganese atom is bound. The scientists report in the journal of the Chemical Society, *CHEMICAL COMMUNICATIONS* (No. 6, p. 729,

1994) that the metal also has four additional carbonyl groups that hold the complex together.

Germany: Carl Zeiss Jena Develops Optical Communication Terminal

94WS0307A Berlin INGENIEUR DIGEST in German Mar 94 p 16-17

[Article by Guenther Ludvik: "Optical Terminal"]

[Text] A cosmic data transfer line for optical communication by means of lasers is to have its world premiere in 1997. Carl Zeiss Jena is part of the development.

The factory sale of reflecting telescopes was almost a matter of routine in Jena. But it was different for the 13th 1-meter reflecting telescope—not only because the signing of the contract in 1991 "coincided with the founding of the Carl Zeiss Jena GmbH company," as managing director Dr. Elk Littow recalls, but because it also meant the entrance of the Jena group into a new generation of technology.

With this telescope Carl Zeiss Jena GmbH is supplying the optical ground station for SILEX, the semiconductor intersatellite link experiment of the ESA. It is intended to create a prototype system for optical data transfer between satellites. By the end of 1995 the first ground station in Europe will be constructed in the mountains of the Spanish island of Tenerife at a height of 2,500 m. It can produce a data link from the ground to a geostationary satellite using optical frequencies.

For ESA program director Anthony Dickinson, SILEX is an important step for the further development of commercial space travel. "No civilian space communications system has previously used laser light as a data link or makes use of the advantages, such as significantly higher data transfer capacity, good protection from interference and surveillance, and extension of the available frequency range for information transmittal."

This is becoming increasingly important. After all, the radio frequencies available in space have been heavily taxed. At the same time, power demands and size of facilities would be reduced, so that deployment on small satellites becomes a possibility.

Zeiss's participation in this innovation came just in time to save the 13th telescope and the attached housing with a diameter of 12.5 meters from landing on the scrapheap. The system had really been developed for astronomical observations and intended for the USSR. The individual components had already been completed, but the Russians could not purchase the telescope because of lack of cash.

A visit from the general director of the German Agency for Space Affairs (DARA), Jan-Baldern Mennicken, came to the rescue. The Thuringians were attentive to the fact that the European Space Agency (ESA) wanted to grant equal opportunity to companies and institutions in the new Federal Laender in their projects. The Jena

group put this offer to the test by offering their system for the SILEX experiment. They redesigned the equipment under contract to DARA and fitted it with the most modern drives and control systems.

For its assignment had changed. In the SILEX experiment a new technological ESA data satellite, the geostationary ARTEMIS satellite, will be deployed. It receives data by means of classical microwave satellite transmission. These will be transmitted from the SILEX laser-optics communications system to the telescope.

In tests, the ground station with the Zeiss telescope is to simulate a future user satellite. The first real satellite which is to use the laser-optics terminal of ARTEMIS will be the French earth observation satellite SPOT-4. Generally it can only transmit imaging data to the next ground station for no longer than 10 minutes from its orbit at an altitude of 700 km.

This means loss of time: data carriers from stations overseas must be transported great distances for evaluation. SILEX, on the other hand, will always make uninterrupted links between SPOT-4 and its control center in Toulouse possible, as long as the satellite is within range of ARTEMIS, located 36,000 km above the equator. The data relay link to ARTEMIS is maintained when SPOT-4 flies over more than half of the land surfaces on earth.

The data rate of SILEX is 50 Mbits per second. ARTEMIS distributes the data received from observation satellites directly to users in Europe.

For this purpose ARTEMIS and SPOT-4 are equipped with 25-cm diameter telescopes for sending and receiving. These are supplied by Jena's former rival and current project partner, Carl Zeiss Oberkochen. Mirrors and structural telescope parts are not manufactured from the lightweight material graphite epoxy, but because of the required accuracy in measurement they are made of Zerodur from Schott, which has no thermal expansion.

DARA managing director Prof. Heinz Stoewer sees in SILEX—at present the only advanced civilian project in optic satellite communications—new dimensions for the communications industry, "one of the most important branches of the economy for the future." He says that Germany cannot afford to do without such high technology or to rest content with vanishingly small market shares in the long run. The civilian market for satellite communications will triple in the next 10 years, from \$10 billion to \$30 billion. "German industrial firms are important sources of innovation. There is the chance for them to achieve a leading position in this area."

The Zeiss people in Oberkochen, who have sufficiently proved their competence in space projects with the development and manufacture of the optics for the X-ray astronomy Rosat satellites, are involved. The Jena group, too, has something to offer: the former collective combine was included in important Soviet space travel projects. Developments like the multispectrum camera

in the 70's and astronavigation systems for satellites in the 80's are among their achievements.

Now the DARA contract was "enormously important for the area of astronomical equipment which is currently being restructured." Along with the new arrangement in the Zeiss Group, Jena has also assumed corporate responsibility for this systems area.

Germany: 270 Million Marks Earmarked for Laser Research

94P60221A Berlin *INGENTEUR DIGEST* in German
Mar 94 p 6

[Text] The BMFT [Federal Ministry for Research and Technology] is providing about 270 million German marks up to 1997 for development of new laser sources and applications. The new "Laser 2000" research focus is intended to speed up the generational change from tube (gas lasers) to semiconductor technology (diode lasers) in Germany. The main thrust of the program is: basic research for new generations of lasers, precision machining using lasers, new applications, and laser medicine. Work on the pilot project on high-power diode lasers has already begun with leading participation of Jenaoptik. According to Dr. Werner Gries of BMFT, the goal is to develop a small high-power, low-maintenance laser that is usable in a wide range of products.

France: REOSC To Market CEA's Optical Thin Film

94WS0273C Paris *AFP SCIENCES* in French
3 Feb 94 p 43

[Unattributed article: "Optical Thin Films: CEA/REOSC Optical Licensing Agreement"]

[Text] Paris—The French company REOSC Optique [Optical Research and Studies and Allied Sciences] will industrialize a process developed by the Atomic Energy Commission's (CEA) directorate of military applications to produce optical anti-reflection or high-reflectivity thin film deposits.

On 24 February, the CEA announced that the licensing agreement that was just signed will enable REOSC to use this "sol-gel" process to make scientific optical components and anti-reflection glass panes, especially to protect art works. The technique was developed at the Limeil-Valenton center in connection with research on military power lasers and is covered by several patents, it consists in depositing by capillarity high-performance thin films, a few microns thick.

The "sol-gel" process uses submicron particles of oxides or fluorides in an alcohol- or water-based medium. After evaporation of the solvent, these particles form a brittle porous optical film, but one of the anti-reflection coatings, Flucosil, is a dense abrasion-resistant and water-repellent composite film.

The process works at ordinary temperatures (around 120°C) and even at room temperature, so that it can be applied to mineral or plastic media. According to the CEA, it can also treat large areas at very competitive prices.

A subsidiary of the French aircraft equipment manufacturer SFIM-Industries [Measuring Instruments Manufacturing Company], REOSC Optique is a world-renowned specialist of high-precision optics for satellites such as Spot. It is currently grinding the first eight-meter diameter mirror of the Very Large Telescope (VLT) that will be installed at the European Southern Observatory (ESO), on top of Cerro Paranal, in Chile.

France: Synthetic Diamond Films Improve Lasers

94WS0273D Paris L'USINE NOUVELLE in French
3 Mar 94 p 32

[Article by Michel Vilnat: "Welding: Diamond To Polarize Laser Beams"—first paragraph is L'USINE NOUVELLE introduction]

[Text] Synthetic diamond membranes that are excellent polarizing filters enhance the quality of laser utilization.

In the near future, a new technology will become available to users of CO₂ lasers, to improve welding quality or cutting precision. They will owe it to ultrathin synthetic-diamond membranes developed by a university team. In fact, researchers at the Paris-Nord university at Villetaneuse just showed that a stack of several of these membranes would form a remarkable polarizing filter perfectly suitable for high-power lasers.

A Veritable "Cross"

A laser beam consists of light waves associated with an electric field perpendicular to the propagation axis. The electric field possesses one horizontal and one vertical component. Polarization consists in favoring one of the components.

Until now, multikilowatt-laser users would make do with bulky and hard-to-adjust kaleidoscopes to mix polarizations in a random manner and achieve a consistent average effect.

The invention of this polarizing membrane filter is the result of a "cross" between two basic research branches. At the Paris-Nord university at Villetaneuse, two teams work a few hundred meters from each other, in entirely different fields. First, the team headed by Alix Gicquel, researcher at the materials engineering and high-pressure laboratory, an expert in synthetic diamond deposition; second, Christian Chardonnet, researcher at the Villetaneuse laser physics laboratory of the CNRS [National Center for Scientific Research], a specialist of advanced molecular research.

After hearing about Alix Gicquel's team's research on diamond membranes, Christian Chardonnet thought of testing them with the ultra-stable CO₂ lasers that are

routinely used in his laboratory. Results were quick to follow. Compared with germanium filters, which until now were considered as the ne plus ultra of polarizing filters, the new system, consisting of six membranes, is 100 times more efficient. Better still, the 1-micron thick diamond film does not bend the laser beam. A realignment device is no longer needed. "The excellent thermal conductivity characteristics of diamond, 20 times better than those of copper, lead us to expect a particularly high permissible power threshold," Christian Chardonnet indicated. Tests should soon be made on a multikilowatt CO₂ laser. So far, only zinc selenide lenses can withstand powers greater than 100 watt, but exceeding 1 kilowatt is out of the question. Besides, they are 1,000 times less efficient.

Christian Chardonnet's polarizing filter is not suitable just for CO₂ lasers. A slight thickness modification and an improvement in the roughness of the diamond window would make it possible to use the device for YAG [yttrium-aluminum garnet] lasers. A promising market! At the same time, diamond membranes can also protect infrared camera lenses. CO₂ laser beams, which have a wavelength of 10.6 microns, will be stopped by a set of crossed slats, while perfect transparency will be retained for wavelengths of 3 to 5 microns, the preferred range of these instruments.

The Secret of Diamond Filter Manufacture

Making a 1-micron thick diamond membrane involves two stages. The synthetic diamond coating is deposited on a silicon plate, the central part of which is then chemically dissolved to leave only the diamond film. The team headed by Alix Gicquel, research at the materials engineering and high-pressure laboratory of the Paris-Nord university, at Villetaneuse, uses the microwave-aided chemical vapor deposition (CVD) process to deposit the synthetic diamond film. The film is obtained from a gas mixture consisting of 99 percent hydrogen and 1 percent gaseous hydrocarbons. The gases are decomposed by an uptake of energy and form a plasma that contains mostly atomic hydrogen and hydrocarbon molecules. The latter contribute carbon, while hydrogen promotes the growth of diamond crystals and prevents the formation of graphite, which would pollute the film. To obtain very thin films, experts try to increase the number of crystals. One solution consists in immersing the substrate in an ultrasonically agitated bath containing fine diamond particles before going on to the chemical deposition stage.

France: LETI, PSA, Sextant Avionique Develop Optical Gyrometer

94WS0306B Paris L'USINE NOUVELLE in French
31 Mar 94 p 40

[Article by Odile Esposito: "A Gyrometer on a Silicon Chip"]

[Text] LETI [Laboratory for Electronics and Data Processing Technology], PSA [Peugeot S.A.], and Sextant Avionique are currently developing a fully integrated optical gyrometer on a silicon chip a few centimeters on a side. Its potential applications are many, in the automobile industry as well as avionics.

The guidance of vehicles, whether they be robots, rockets, planes, missiles, or simply automobiles, has become a topic of research of major interest to industrialists. Determination of the vehicle's trajectory necessitates the use of an instrument that measures speed of rotation, namely, the gyrometer. The problem is to design and build a gyrometer that is at one and the same time reliable, economical, small, and as easily integrated into an automobile as any ordinary electronic component. The CEA [Atomic Energy Commission]-LETI integrated optics laboratory at Grenoble has been working on this problem for the past several years, in cooperation with PSA and Sextant Avionique. After having demonstrated the feasibility of integrating such a component on a silicon substrate, they have now received financing in the amount of 11 million French francs [Fr] from the Ministry of Research and Higher Education, under the Technological Leap program, to develop the device and prepare its industrialization.

"The use of optics for gyrometers is now very old," says Patrick Mottier, head of this LETI laboratory. "It has been used in the laser and fiber-optic gyrometers developed by firms such as Thomson and Photonics." But use of these very costly devices (around Fr10,000 for the gyrometers used in some Japanese cars) is essentially confined to rockets, submarines, and satellites. With the advances being made in integrated optics—enabling the production of conventional components (lenses, mirrors, separators, etc) on a glass or silicon substrate—the idea of developing an integrated optical gyrometer has made way rapidly.

Many Difficulties Need Surmounting

The principle of this device rests on what opticians call the Sagnac effect: A light guide, wound spirally, is fed at both ends by one and the same light source, a laser diode. The resulting two light beams circulating in opposite directions produce interferences, and, as this light loop rotates, the difference in level of interference is linked directly to the speed of rotation. In fiber-optic gyrometers, the light guide consists of an optical fiber several thousand meters long, wound in a loop some 10 centimeters in diameter.

In the device developed by LETI, the optical fiber is replaced by a light guide on silicon, 80 centimeters long and 3 centimeters in diameter. "To lower production costs and attain components costing a few tens of French francs, we would like to reduce the size of this loop," says Patrick Mottier. "But we are limited by propagation loss along the ring." The principal drawback of these integrated optical devices is in fact their optical loss, which

is 10,000 times that of fiber types. If the circuit is too long, the signal is greatly attenuated and becomes impossible to detect!

Reducing Manufacturing Costs

While LETI has contributed its components-integration skills, PSA and Sextant have worked mainly on the signal processing. The two firms do not by any means have the same philosophy in this venture. "PSA approaches it as a potential user. Sextant, on the other hand, wants to master the technology of producing these optical circuits," says Patrick Mottier. Be that as it may, the three partners, as of now, are bent on improving the prototype they have developed. Their objectives: reduction of optical losses, choice of a better source and the optimal frequency, and above all, lowering of the eventual manufacturing cost. The outlook: many long months of work!

MICROELECTRONICS

UK: Cost-Competitive Optoelectronic Silicon Chips Developed

94WS0352D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 May 94 p 8

[Article: "Cost-Effective Optoelectric Chips"; Subhead: "Brits Improve Process for Production of Porous Silicon"]

[Text] Frankfurt—Extremely porous crystalline silicon can be used in circuits to emit light in the visible spectrum range. This phenomenon, discovered in 1991 by British scientist Leigh Canham, enables production of new, cost-effective opto-electric chips for communications engineering. To fabricate the highly porous silicon Canham employed a then special electro-chemical caustic technique that since then has turned out to be hard to control. He has now perfected a modified production technique that can be better controlled and directed.

This new technique makes use of a supercritical fluid and is characterized as "supercritical drying." It results in the ability to remove the fluid used to create the pores in the supercritical state without being able, in the process, to result in the development of addition-reaction films by the fluid with the silicon. Additionally, no shrinkage phenomena surface, so that the size and structure of the pores remain fully intact.

The special drying technique has been used so far for the production of porous solids that likewise display extremely high porosity. Even in the case of silicon it creates the desired porosity by nearly more than 95 percent of the silicon's volume. Preliminary sample materials, produced still using laboratory techniques, reveal an extremely uniform crystalline structure of columnar crystals that guarantee high solidity. Porous silicon is especially advantageous since it is considerably cheaper to produce than film-like gallium arsenide structures that have been used until now for experimental

optoelectronic circuits. For further information: DRA, Malvern, Worcester WR14 3PS, United Kingdom.

Netherlands: Five-Year Prorisc Chip Program Funded

BR0905142494 Amsterdam COMPUTABLE in Dutch 4 Mar 94 p 3

[Unattributed article: "30 Million for Chip Program"]

[Text] Utrecht—During the next five years the Foundation for Technical Sciences [STW] will inject as much as 30 million guilders in the chip program Prorisc. This will serve as a platform for researchers in the broad field of microelectronics; from the manufacturing of simple chips to the design and realization of complete systems, including peripheral electronics. STW's annual report announces that 60 researchers are involved in the Prorisc program. Contacts also exist with researchers from Belgium. Prorisc is recognized by the IEEE, the American Institute of Electrical and Electronics Engineers.

Netherlands: Bacteria Found To Etch Silicon Chips

BR2904105394 Amsterdam COMPUTABLE in Dutch 15 Apr 94 p 2

[Article signed MP: "Bacteria Etch Silicon Chip"]

[Text] Enschede—The Mesa Institute of the Technical University [of Enschede] by chance discovered bacteria that can etch chips. The research group Biosensors has been experimenting for quite some time with silicon sensors on which a layer of biologically active material was applied as a breeding ground for enzymes and bacteria. By accident the bacteria of the strain *Coli Silica Etcher* appeared to affect the silicon material. This property is now being used to etch chips. The biological material is kept on the "right track" by applying lethal chemicals on the interfaces. Meanwhile, miniature microphones have been manufactured using this new method.

German University Laboratory Perfects Economical LCD Screens

BR2204134194 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 14 Apr 94 p 17

["E.F." report: "14-Inch Color LCD Screen Prototype in Germany"]

[Text] Stuttgart/Hannover—The technology developed in the screen-technology laboratory of Stuttgart University could, according to its inventor Jens Glueck, solve the current problem of low luminosity efficiency and the resulting high prices of active-matrix LCD screens. The new technology uses a potentially less expensive transistor matrix manufacturing process with four masking techniques as opposed to five or six for the Japanese products currently available on the market, while

offering a comparable image quality. Again according to Jens Glueck, the quality would be better than that obtained with the two-stage masking process developed by Planecran, a technique that is now owned by Flat Panel Displays: "Unlike the Planecran approach, each pixel has its own storage capacitor. We have optimized the pixel design to obtain an aperture ratio of 60 percent and thus ensure greater brightness." The feasibility of the technology has recently been proven with the presentation of the first 14-inch color prototypes. These screens, with a resolution of 575 x 696 color pixels, compatible with video refresh rates, are not completely bug-free, however. Jens Glueck said: "These faults do not arise from the technology itself, and can be eliminated by extra research on peripheral devices, command circuit connections, etc." In addition, negotiations are underway between Stuttgart University and IBM which envisages launching a project for the industrialization of the process by its German subsidiary. Negotiations are in particular centered on the financing of the project and the possible introduction of additional partners. As a result, the initial screens produced using this technology will probably not be commercially available for another two to three years.

The technology patented by Jens Glueck is of the inverse grid type, but is simpler than conventional inverse grid technology. The first masking stage consists of depositing a 200 nm-thick layer of chromium which is then etched to produce the lines and lower electrodes of the storage capacitors. Four layers are then deposited: the grid insulator (SiNx); the undoped semiconductor material (noncrystalline hydrogenated silicon, a-Si:H); the n+ doped semiconductor material (n+ -a-Si:H) for the drain and source electrodes; and an aluminum/chromium alloy (Cr/Al/Cr) for metallization. The absence of any intermediate etching eliminates the losses in efficiency usually experienced with the inverse grid process. This method moreover protects column metallization and prevents short-circuiting at the row/column cross-over points.

End-of-Etching Control Without a "Blocker"

The second masking stage consists of simultaneously etching the metallization and the doped semiconductor to create the columns, drain/source electrodes, and the upper capacitor electrodes, while carefully controlling the optical emission of the etching source (CF402 etching plasma) to avoid "over-etching" which would attack the layer of undoped semiconductor (this problem is avoided in five or six-stage masking techniques by using an etching "blocker" which requires an additional masking stage). The last two masking stages consist of etching the undoped semiconductor to create the pixel, and then depositing and etching the ITO (indium tin oxide) layer to make the electrodes. This layer serves both as an extra metallization layer and a patch for broken columns.

German Participant Criticizes JESSI Program

MI2104115794 Munich SUEDEDEUTSCHE ZEITUNG
in German 17 Mar 94 p 34

[Interview with Professor Dr. Heinrich Kurz, director of the Institute of Semiconductor Technology, Aachen Technical College, by Jeanne Rubner; place and date not given: "Is The JESSI [Joint European Submicron Silicon Initiative] Project A Failure?"]

[Text]

[Rubner] The federal research minister recently spoke positively about the European microelectronics project JESSI [Joint European Submicron Silicon Initiative]. But critics speak of window dressing. As a researcher who was involved in JESSI, how do you see it?

[Kurz] It is more than window dressing, but we must take into consideration that it was not the federal minister who landed us in JESSI. JESSI is, so to speak, an old boys' network, and a minister who is a layman is taken in by the window dressing. The fact is, there is a vast discrepancy between the claims and the results. None of JESSI's big "flag ships" has got off the ground. On the contrary, the fleet has almost sunk already.

[Rubner] Can you tell us what the project's most important flag ships were?

[Kurz] Apart from the clusters, the joint projects in manufacturing technology, which were also not particularly successful, there are five applications flag ships. These are: high resolution television, digital broadcasting, broadband communications, mobile radio, and safety electronics for automobiles. The high resolution television project has just gone under, mobile radio is firmly in the hands of firms that were not sponsored by JESSI. The problem is that there were several changes of strategy. Industry regarded JESSI as a sponsorship program for itself in which firms need not have clear objectives.

[Rubner] Yet the European semiconductor industry still has only a small share of the world market. Surely more must have gone wrong than just a change of strategy?

[Kurz] The failings go back 15 or 20 years. The five-year program running until 1996 has at best delayed Europe's withdrawal from the world market. Initially, JESSI was not intended to be a program for capturing the market, but to create the technological basis for the microelectronics industry. Only later were substantial parts of a basic program abandoned to press ahead with applications.

[Rubner] Applications are not necessarily bad. Where did JESSI go wrong?

[Kurz] If firms are always looking out of the corner of their eye for more competent partners outside of JESSI, there is bound to be failure in applications.

[Rubner] With 150 firms involved, does that not entail an enormous amount of bureaucracy?

[Kurz] Here we have Europe's old complaint again. The money that was spent on administration could have been put into basic research or given directly to competent firms without them having to find a pseudo-common objective. But all European projects have this problem.

[Rubner] Among others, a European CAD [computer-aided design] software program is cited as a successful JESSI project. Why was it worth spending millions on it?

[Kurz] I don't understand it at all. But JESSI sets great store by the project partners talking to each other. It would of course have been more honest if JESSI had been called a political integration program from the start.

[Rubner] Have there been technically good results?

[Kurz] Yes, isolated ones in the areas of the clusters I mentioned. But the question remains whether the progress was not rather the result of ideas from the USA or Japan, or from JESSI. By the way, one particular misjudgment was X-ray lithography.

[Rubner] But most experts didn't expect it would be possible to make the 64 megabit chip without X-ray lithography.

[Kurz] That isn't the case. There are a lot of predictions about how far optical lithography will go. They were still talking about X-ray lithography in JESSI when the Japanese were already announcing the 64-megabit chip with optical processes.

[Rubner] JESSI runs out in 1996. What ought to come then?

[Kurz] Certainly not a repetition. We already know how JESSI will end. The people with political responsibility should already be setting up an independent commission of enquiry so that competent experts can talk about the next stage. The most important questions are: What is a long-term research strategy? What is the correct form of involvement for the universities, Fraunhofer Institutes and others? We need new methods to better develop Europe's existing potential. There should at all events be greater [financial] support for basic research, particularly in the direction of automatic mini labs, that is small factories in which special chips, Asics [application-specific integrated circuits] for short, are made. Funding should be awarded solely according to scientific and technical criteria—not like in JESSI, where industry acted like a society for self-advancement in deciding who would get money.

Microsystem Technology Status, Prospects Assessed

94WS0275A Duesseldorf VDI NACHRICHTEN
in German No 9, 4 Mar 94 p 17

[Text] Experts credit to microsystem technology no less of a key position than to microelectronics. Germany is taking a lead with its research facilities, and great possibilities are also opening up for industry. Small and medium-sized companies, however, are still experiencing serious problems in developing marketable products.

"Microsystem technology constitutes an expansion of microelectronics," Prof. Dr. Anton Heuberger emphasized at the presentation of the BMFT's [Federal Ministry of Research and Technology] promotional program "Microsystem Technology" on February 18th in Sankt Augustin, "which will achieve a key importance still in this century similar to that of microelectronics today." The director of the Berlin Fraunhofer Institute for Silicon Technology (ISIT) is confident that this key technology which has the goal of "integrating microelectronic and other functions such as optical, electromagnetic, mechanical, chemical and even biological into one miniaturized solid state system" holds great importance for German industry. "Germany's prospects and qualifications in microsystem technology are incomparably better than in microelectronics."

The initiative in microsystem technology "has led to an extremely substantial and broad research infrastructure in Germany," which for Heuberger is "a very good fundamental basis for industrial development." Now care must be taken that national support does not get pushed toward basic research but instead fully demands the relevance [of such research] to industry. Production technology and system reliability also continue to be decisive factors and "not only [whether] new systems are feasible in principle." Also required are a consolidation of themes and leadership in industry. However, "the early support of industry also produced a significant level [of work] here, in comparison with other countries, which after the initial difficulties culminated in a fruitful coexistence of large and small industry." And industrial sectors such as automotive technology, telecommunications, medical technology or metrology and control engineering, "which are particularly dependent on microsystem technology," are well represented in Germany as well as in Europe.

The victory is far from won, however. The Fraunhofer director referred to the example of Japan with its "micromachining" successor program, where the greatest potential danger lurks. "The entire program is carried out there in large industry as a supplement to microelectronics, which is already strong there as it is." Heuberger's fear is that the Japanese could begin product development earlier and more consistently. Nothing is yet decided, but the problems which are still to be solved by the German initiative in microsystem technology "are incomparably more difficult than those in microelectronics, where we have already not solved the problems."

Also the European JESSI [Joint European Submicron Silicon Initiative] program "does not cover important methods and technologies of system integration and system technology because of its concentrated focus, desired by industry, on memory or storage technology." The weakest aspect is the software: without elaborate software simulation systems and design tools, which are not on the market yet, there can be no industrial production of microsystems. "If we do not succeed at least in building up and sustaining an industrial software supplier and in not having to buy system software from the USA as we have done, it is all pointless," Heuberger warns.

However, microsystem technology still offers great opportunities, also and specifically for small and medium-sized industry in Germany. As Helmut Hund, director of the sensor production company of the same name in Wetzlar, emphasizes: "Usually, the manufacturing processes of semiconductor technology are not accessible to companies of this size." For companies of between 20 and 1,000 employees doing business of between a few and several hundred million German marks, it has been nearly impossible up to now to get into technologies like design and simulation, lithography, wet and plasma etching technology, or coating and testing technology.

The situation is completely different in microsystem technology, with small volumes of a few thousand units. No longer do smaller structural dimensions or larger and more complicated memory determine the level of innovation in microsystem technology, as is the case in semiconductor technology; [innovation] is instead determined by the intelligent combination of various technologies in the areas of micromechanics, application specific IC design and sensor construction. "Small-scale manufacture combined with relatively economical manufacturing processes offer small and medium-sized businesses an ideal opportunity against the large companies. It offers an opportunity because the price pressure is nowhere near as great as with the semiconductor standard components."

There are also hidden risks in microsystem technology, however. "The wildest chip ideas come to nothing if the corresponding products are not [as written] lacking which can be used in industrial and everyday life." The practical Hund sees Germany's biggest current problem here. "In every possible presentation and in the technical journals there is talk of insulin pumps, of miniature robots and of micromechanical drive systems," Helmut Hund says mockingly, "but sales are not yet being made with products containing these components." Small and medium-sized businesses are demanding support not only for technologies but also for the development and marketing of new products.

As a man of experience, Helmut Hund knows first-hand the problems of small and medium-sized businesses. "No small or medium-sized business has the financial resources to reserve all the hardware for microsystem

technology alone." His credo is, therefore, not to make everything alone but rather for small and medium-sized businesses to work together from cooperative research to realization of the product, a concept for which Hund has coined the term cooperative technology. Hund the businessman grew up in the country and knows what he is talking about: "Many farmers could only buy a harvester together which they would have been unable to afford individually." However, large companies, too, should make use of joint solutions with small and medium-sized businesses. Hund: "Then the call for a German MITI [(Japanese) Ministry of International Trade and Industry] or similar institution would no longer be necessary."

Big business, meanwhile, emphasizes its leadership role. "For rapid industrial development and the use of microsystem technology in new products, some mass markets will probably be essential at first in which unit price is low and high unit numbers of elements, sensors, actuators and components are used, such as in automobile technology or domestic and home appliance technology"—of this Dr. Horst Schmidt-Bischoffshausen from research and technology at Daimler-Benz AG in Munich is certain. Accelerator sensors for airbags or rpm and torque sensors for controlling ABS and powertrains are examples of current mass production of microsystems at the element level.

Companies which would like to participate in the BMFT [Federal Ministry of Research and Technology] promotional program may contact the VDI [Association of German Engineers]/VDE [Association of German Electrical Engineers] Technology Center Information Technology, Rheinstrasse 10b in 14513 Tetlow. Telephone 03328/435-0.

Photo caption: The micromechanical scanning system with a directable mirror made of silicon can direct laser beams, for example. Economical uses, such as in laser printers, might be possible. *Photo: TU Chemnitz-Zwickau*

NUCLEAR R&D

France: March Against Superphenix Reactor Organized

BR1204143894 Paris LE MONDE in French
10-11 Apr 94 p 22

[Report by Michel Castaing: "Demonstration Against Superphenix Intended To Rouse Antinuclear Movement"]

[Text] The protest march to be held from 9 April to 8 May by the "Europeans Against Superphenix" ecologist group, going from Creys-Malville in the Isere region of France to the prime minister's residence in Paris, is intended to reawaken the antinuclear movement in the light of the upcoming national debate on energy and June's European elections.

After years of tranquillity, the hamlet of Faverges, in the north of the Isere region, was peacefully invaded on the morning of Saturday 9 April by the first participants—some 1,000 people—in the antinuclear march organized by the Europeans Against [the] Superphenix [nuclear reactor]. (The coordinating group of this group consists of six organizations: the Malville committee (Lyons), the FRAPNA (Rhône-Alpes Federation for the Protection of Nature), Greenpeace-France, the GSIEN (Group of Scientists for Information on Nuclear Energy), and the World Wildlife Fund, from Milan. It also includes some 300 associations or groups, including political parties (the Greens, Generation Ecology, the Greens in the European Parliament, and Red and Green Alternative), and several dozen foreign organizations, predominantly German and Swiss.)

Faverges had doubtless seen nothing like this since that dramatic Sunday 31 July 1977 when a major antinuclear rally (over 20,000 demonstrators) degenerated into violent clashes with the police, leading to the death of a 30-year old pacifist schoolteacher, Vital Michalon who was killed by a grenade. Prior to departure [passage omitted] a commemorative plaque was unveiled to his memory.

This march, which will take the ecologists to the Paris Science and Technology Park before moving on to the prime minister's office on 8 May, marks the awakening of an antinuclear movement which has lost much of its sting in recent years, in particular in the area around the Superphenix. The local reasons for this are twofold: first, the fast breeder reactor has been shut down since 2 July 1990, and concerns have thus been lulled; secondly, maintenance operations have created some 2,500 jobs.

Previously openly opposed to Superphenix, the mayor of a small neighboring town expressed an opinion widely shared in the region: "We all have relatives working in the power station, so now is not the time to be picky, even though I am still aware of the specific risks posed by the reactor."

It was the government's decision, made on 22 February, to use Superphenix not as a nuclear power station but as a "reactor dedicated to research and experimentation," that jarred its opponents back to life. Europeans Against Superphenix reiterates that "it was during safety experiments that Soviet engineers caused the worst accident in nuclear history." Throughout the journey the caravan of protesters will hammer out a slogan worthy of [French satirist and comedian] Coluche: "If you laughed at Chernobyl, you mustn't miss Creys-Malville!"

Highly Symbolic Stop-Off Points

"Pull the plug on Superphenix!" declares the 15-meter long banner leading the procession out of Faverges, indicating that the protest is focused firmly on the only industrial-scale fast breeder reactor in the world and that the ecologists do not intend getting way-laid by more general issues.

The whole range of arguments against the use, in whatever form, of the Creys-Malville plant is used, including its high cost and the risk it poses: "In 20 years, this reactor has already cost over 50 million French francs [Fr], has only operated for 176 days and still wastes Fr600 million a year"; and "Superphenix still contains 5 tons of plutonium and 5,000 tons of sodium." (Superphenix cost Fr27.7 billion in today's money to build, Fr7.65 billion of which in interim interest. Maintenance costs Fr650 million per year (Fr750-800 million in 1993). To completely abandon it would cost Fr12 billion, to which can be added Fr18 billion in compensation for France's partners. The station operated for 7,400 hours (slightly more than 300 days) since being hooked up to the EDF grid in 1986. Fuels used total 5.5 tons of plutonium, while 3,500 tons of the 5,000 tons of sodium are still contained inside the reactor tank.

Encouraged by a precedent—three days before the scheduled restart date of 2 July 1992, the then-Prime Minister Pierre Bérégovoy froze any decision—and guessing that the Balladur government will not make any further decisions on restarting the reactor before the European elections in June, the anti-Phenix movement intends putting this period to the best use by exerting as much pressure as possible. All the more so, of course, since the national energy debate opens at the start of May.

The fliers that are to be distributed from Faverges to Paris state: "We must put a stop to this costly, dangerous, and useless experiment... Errare humanum est, perserverare diabolicum [to err is human but to persevere is diabolical]." Abandoning the reactor would be considered "a brave and positive act." The antinuclear lobby has also broken away from its radical attitudes of the past, at least in appearance.

In this way, Europeans Against Superphenix is thus again out campaigning for support. Greenpeace-France hoped that "the march can trigger a chain reaction along its route, mobilizing sectors of public opinion reaching far beyond traditional ecologist groups. Everyone understands that, behind Superphenix there is the need for a greater transparency in the debate on energy choices in France."

This is why highly symbolic stop-off points have been chosen, such as the Lyons headquarters of the NERSA, the Superphenix operating company; the power stations at Fessenheim (Haut Rhin), Cattenom (Moselle) and, on 26 April (eight years to the day since the Chernobyl disaster), the station at Nogent-sur-Seine; the European Parliament in Strasbourg, and so on. The march will also pass along some Swiss towns (Geneva, Lausanne, and Basle), and, the organizers insist, it will also visit a number of "alternative sites" promoting renewable energy sources. The caravan will also be running a campaign of postcards addressed to the prime minister.

France: Implications of Restarting Superphenix Reactor

94P60142A Paris LE MONDE in French
25 Feb 94 p 10

[Text] The fast breeder reactor at Creys-Malville (Isere), which has been transformed by the government into a simple tool for research and experimentation, could be restarted this summer to operate for the first few months at low power levels. A new page has been turned with this decision (LE MONDE 24 February). The public authorities have made a clearly nonprofit-oriented choice regarding the fate of this installation costing 27.7 billion French francs [Fr] supporting the recommendations made in mid-January by DSIN (Nuclear Installations Safety Directorate), for whom power production at Superphenix was no longer a priority.

The industrial logic has thus given way to research programs. As the Hotel Matignon communique explained it. EDF (France's Electric Power Co) "will have no authority over Superphenix' operating power levels," but states that CEA (Atomic Energy Commissariat), a purely research organization, will henceforth enter the game with EDF and NERSA (Nuclear Energy Association), which is responsible for the plant's operation.

Thus, Superphenix will operate in stages to adapt to a research program that is to be proposed by a supervisory committee combining NERSA, EDF, and CEA, one or two months from now. This program, evaluated by Robert Dautray, high commissioner for atomic energy, and Claude Detraz, director of CNRS' (National Center for Science and Research) National Institute for Subatomic Physics, will be monitored by a scientific committee, which will issue a yearly report on the experiment conducted.

For Gerard Longuet, minister of Industry, Posts, Telecommunications and Foreign Trade, and for Francois Fillon, minister of Higher Education and Research, this program should permit "the preservation of our (France's) lead in the fast breeder field," and determine the ability of this way "to generate power while managing the plutonium produced, and burning up nuclear waste over the long term." Are these also the choices of EDF's partners within NERSA, Germany's SBK (Fast Breeder Power Plant Co) and Italy's ENEL (Italy's Nuclear Electric Power Co). The government, while awaiting the answers, is saying that they "(should) accept their responsibility and pay the costs." In fact, there are some people who are not opposed to reviewing the levels of participation of SBK or ENEL, or, if worse comes to worse, seeing one of them drop out of the project altogether. Everyone knows that abandoning the reactor could cost Fr8-12 billion, and that litigation on this point with France's partners could raise this to 18 billion.

France: Massive Investment Planned for Nuclear Explosion Simulation

BR0905100194 Paris LE FIGARO in French
23-24 Apr 94 p 8

[Jean-Paul Croize report: "Nuclear Explosions Inside Computers"]

[Text] When the military planning law for the period 1995-2000 was presented, it was revealed that between now and the end of the century more than 10 billion French francs [Fr] are to be invested in developing a highly-sophisticated system for simulating nuclear explosions. This is a major scientific decision since it will enable experts at the French Arms Delegation (DGA) and the Atomic Energy Commission [AEC]—who have been pondering the design of such a system since 1991 in the framework of the Palen program (for the preparation and limitation of nuclear testing)—to devise new methods for performing heavy-duty studies and experiments. Notable developments include extremely powerful lasers and high-performance computers which would also have considerable benefits for the civil domain.

While it is hard to imagine, the means do exist for simulating or partially reconstructing the diabolical energy release that is characterized by the triggering of a thermonuclear bomb. Better still, while the most complex means of simulation are still confined to the realms of theory, certain others already exist in concrete form. In two decades these resources have reduced the annual number of real nuclear tests carried out on the Mururoa Atoll in the Pacific Ocean from a dozen to just five, before the total test ban moratorium was imposed in April 1992.

The equipment already used in a number of Defense Ministry research centers make it possible to reconstruct some of the main mechanical or electromagnetic effects of a nuclear explosion, such as the blast, the heat wave, and the high-energy radiation flux that is generated. One of the simplest simulation tools to design—but still delicate to use and particularly impressive to see in action—is the giant blast tunnel at Grammat in the Lot region of France. Some 110 mt long and 12 mt wide, this structure, camouflaged to blend into the countryside, makes it possible to subject different types of military equipment to a very violent and instantaneous pressurization caused by the release in less than one-hundredth of a second of 300,000 lt of air stored in giant compressors. This involves generating 8 million times the normal atmospheric pressure, equivalent to the shock wave of a thermonuclear explosion, which, in the tunnel, sweeps jeeps aside like mere wisps of straw.

Another, less spectacular example but equipment that is doubtless even more complex to use, is the "radiation chamber" that has been built in the Vernon ballistics and aerodynamics research laboratory. This tool—the only one of its kind in Europe—makes it possible to subject

all types of electronic components to the kind of intense electromagnetic flash generated by an atomic bomb.

However, scientists have yet to implement the most difficult type of nuclear simulation: reconstructing the processes that lie at the heart of the explosion and which, in a few hundredths of a second, cause matter to change into other, lighter, atomic elements, generating an enormous amount of energy in the process. To improve the effectiveness of existing weapons and to design new ones—like the famous neutron bombs—it is vital to be able to accurately predict the operational effectiveness of various kinds of architecture and to select one material in preference to another. As a result it is essential to have "keys" composed either of real tests or a series of physical simulations and calculations using codes detailed enough to accurately determine by "virtual" means the way in which this energy will be released and then dispersed.

If they are to pinpoint the actual transmutation of elements during an atomic explosion, scientists in the AEC's military applications department will have to develop the two tools that are essential for any nuclear simulation: power lasers and massively parallel computers. The credits awarded for this task for the five years covered by the military planning law far exceed those currently allocated: the decision to invest a sum of Fr10 billion practically multiplies tenfold the budget for the Palen program which this year stands at Fr300 million.

On the computing level this will be enough to provide considerable stimulus for the work being done in France in the field of so-called "massively parallel" computing: using machines whose architecture is such that they can perform simultaneous rather than successive calculations interactively—i.e. in parallel. This technology is still in its infancy, but it appears to be the only way of processing the phenomenal amount of data (people are talking of several hundred billion instructions per second) that this type of simulation requires—even harder to do, say the experts, than atmospheric modeling.

Mastering such computing power, the experts claim, could only benefit the resource-hungry calculations used in weather forecasting and computer-assisted aircraft design.

In the field of lasers, the Palen program would enable France to build tools performing better than Phebus, the most powerful device currently being used by the AEC in Limeil, near Paris. Capable of delivering power of almost 10 kilojoules for about a billionth of a second, this would already be enough to light veritable miniature suns heating minuscule samples of matter to over 10 million degrees. The matter would then be converted into plasma such as is found in the core of a thermonuclear weapon. A major line of research in future years will consist of designing a system for amplifying the flashes emitted by such types of equipment to exceed the

performance of the American "Nova," currently the most powerful laser in the world that can put out around 50 kilojoules in flashes of light emitted in a single time period of around one nanosecond.

In the civil domain, tools such as this would make it easier to examine the technology needed to master continuous fusion, i.e. generated in reactors that can supply infinitely more energy than existing atomic power stations. However, if we are to believe many military experts, several more real nuclear tests are needed to perfectly calibrate their data with the processes that occur inside a real bomb.

France: Bordeaux May Get Nuclear Test Simulation Laser

BR1904121194 Paris LES ECHOS in French
18 Apr 94 p 13

[Bernard Broustet report: "Francois Leotard Strengthens Bordeaux Scientific and Military Pole"]

[Text] The Aquitaine region is to receive some compensation for the loss of thousands of jobs resulting from cuts in a number of arms programs. In Bordeaux last Friday, Defense Minister Francois Leotard confirmed that the European Molecular Chemistry Institute (created on the initiative of the Polytechnic School) would be sited in the city. He also announced that a major investment concerning the region would be included in the military planning law. The minister gave no further details. One possibility is the installation of an enormous laser in the region's Atomic Energy Commission [AEC] establishment.

Investment Worth 200 Million French Francs

The siting in Bordeaux of the Molecular Chemistry Institute was announced two years ago, but the plan then seemed to get bogged down. Certain members of the Paris scientific community put up some resistance to the institute being located in the provinces. Francois Leotard's very clear statements on the subject appear to indicate that these objections have been lifted, and that the institute will indeed be created.

Most of the estimated cost of 200 million French francs [Fr] will come from local authorities (the Bordeaux city council, the general council of the Gironde department, and the regional council of Aquitaine) with the European Union also contributing through the European Social Fund, according to the terms of objective 2.

Based in Pessac, near the university, in two to three years time the institute will be host to dozens of researchers from the Polytechnic School and the universities of Louvain (Belgium) and Lausanne (Switzerland). The number of researchers and engineers could exceed 200 at the turn of the century. It will serve to considerably strengthen the already not insignificant potential of the region in the solid chemistry field.

The other investment announced by Francois Leotard could be worth a great deal more. If the laser theory turns out to be true, the figures could run into billions. Designed for nuclear test simulation, this high-powered device could also be put to other uses by Europe's scientific community.

TELECOMMUNICATIONS

UK: Optical Communications Market Seen Growing

94WS0352B Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 2 May 94 p 8

[Article: "Consultant: Strong Growth in Optical Communications Market"; Subheads: "Impetus from Heavy Demand for Local Area Networks and Network Routing"; "Expansion in Asia and Europe"]

[Text] Frankfurt—Stimulated by the rapidly increasing demand for beam waveguides for local area networks [LAN] and LAN routing, the optical communications market should more than double internationally from \$4.4 billion in 1992 to an estimated \$9.1 billion in 1999, according to a market report by the U.S. consultancy firm of Frost and Sullivan, Inc.

The report also predicts that the beam waveguide cable will lose its relative importance as a current driving force for market growth in proportion as market focus shifts to shorter communication paths and this should lead to greater demand for optical transmitters, receivers and routing facilities.

As predicted by the consultants, beam waveguide cable will shrink from 59 percent of the total market in 1992 to 44 percent in the year 1999, whereas receivers will increase in the same time period from nine to 17 percent since new technologies will facilitate connecting a number of receivers to shared transmitters. Market share for transmitters, in turn, will rise from 24 to 27 percent, for connectors, from six to eight percent and for couplers, from three to four percent.

Originally, beam waveguides were installed above all on U.S. long-distance networks. But when expansion of the system was able to be mostly concluded in recent years, beam waveguide installation shifted to international traffic and increasingly to LANs and LAN routing.

Up until now the optical communications industry has been dominated by North America, accounting for 48 percent of turnover in 1992. According to the report, there is likely to be a decrease since shipments from Pacific Rim countries can be expected to increase from 21 to 25 percent and from Europe, from 20 to 23 percent. Pressure to compete globally will increasingly move to the center of planning by manufacturers operating internationally.

The consultants expect that there will be increased installations of beam waveguide systems. On the other hand they will be curbed by costs that still continue to be comparatively high. A large number of new market participants will be joining the global competition and strategic alliances are likely to attract a sizable share of the international market. As regards the micro-electronic undergirding for optical communications, the analysts proceed on the assumption that opto-electronically integrated circuits, even in the early phase of their development, are likely to be an increasingly attractive emergent and cost-effective alternative to the current status of component engineering, since they will contribute considerably to enhanced system performance. It is highly probable that fiber optic amplifiers will displace expensive electronic regenerators in optical long-distance communications systems.

The report "World Fiber Optic Communication Markets" is priced at \$16.95 and is available from Frost and Sullivan Market Intelligence, Sullivan House, Grosvenor Gardens, London SW1, ODH, U.K. Fax: +44717303343.

EC Telecommunications White Paper Outlined

BR0905123494 London *MOBILE COMMUNICATIONS INTERNATIONAL* in English Spring 94 pp 42-45

[An article by Ian Holt of Coopers & Lybrand: The Mobile Green Paper]

[Text] Just before Christmas last year, the European Commission's telecoms policy directorate produced a draft of its long-awaited Green Paper on mobile communications. The full document, pending official adoption by the Commission and translation into all of the Union's official languages, is expected at the time of writing to be published in March/April 1994. Ian Holt, who contributed to its development, looks at the main points of the Green Paper, the background to it, and its importance in the overall scheme of things.

Construction of European telecommunications policy started in earnest with the publication of the 1987 telecoms Green Paper. The strategy was to tackle the fixed area directly, and to address mobile and satellite communications separately. A Green Paper on satellite policy appeared in 1990, but the mobile Green Paper seemed to drift off the agenda.

Therein lies an apparently famous fact about the mobile Green Paper—that it is two years late. This stems from linking the Green Paper (like a lot of things) to the deadline for completion of the single market by the end of 1992; it does not refer specifically to the state of development of the mobile sector itself.

In fact, in these terms, the timing of the Green Paper is about right, coming at a point where the balance of opinion believes that a large consumer market for personal communications is going to develop. This provides

a strategic focus for policy development and a forward-looking context for analysis of the current environment.

In 1990-1991, a formative period for the shaping of mobile trends as well as telecoms policy, the Green Paper would have had less of a sense of direction. And since actions were already being taken to promote pan-European mobile communications and introduce competition (second GSM licenses being granted in France, Germany and elsewhere), it would have had less to say.

As it is, the Green Paper is able to build on recent technological, market and policy advances to propose new directions of consequence to telecommunications as a whole.

Main Goals of the Mobile Green Paper

The Green Paper is driven by two main aims.

Single Market

The first of these is to ensure the existence of a Union-wide market for mobile communications. European telecommunications policy has been largely shaped through application of the single market and—of particular relevance to telecoms—the competition provisions of the EEC Treaty, and the present Green Paper is no exception.

Mobile services currently remain outside the scope of the EC directives which carry the main thrusts of telecoms policy, concerning market opening, licensing and open network provision (ONP). A core job of the Green Paper is therefore to propose how to extend these directives and the principles embodied in them into the mobile area, taking account of the specific circumstances of the sector.

Pursuing the single market aim in the fixed telecommunications area has set an important context for the Green Paper. In June 1993, following the Commission's 1992 review of telecommunications, the Council of the European Union plumped for full liberalisation of telecoms services starting in 1998. For mobile policy, a key question arising was how to interpret full liberalisation in a sector where limited frequency availability leads to restricted entry. Of a more strategic nature, it became of interest to consider what new factors would come into play as a consequence of dissolving the regulatory boundary between fixed and mobile service areas.

Development of Personal Communications

The second aim comes from within the sector itself, and gives the Green paper its strategic focus. This is to push the development in Europe of a mass market for personal communications services (linking this to a point with the "Trans-European Networks" initiative introduced via the Maastricht Treaty). In part, this is because the Commission sees personal communications as an area in which Europe could lead the world, building on the success of GSM.

The Green paper suggests that as many as 80 million Europeans could be users of mobile personal communications by 2010, with ultimate potential to reach 80 per cent of the total population (i.e., one connection per adult—easily exceeding the penetration level for fixed telephony). The most critical factor for achieving mass market penetrations is seen to be the price of handsets; it is predicted that take-up will accelerate significantly once prices fall below 250 ECUs.

It is envisaged that personal communications will be based, at least initially, on combinations of existing systems such as GSM, DC51800 and DECT, together with intelligent functions providing mobility services on the fixed network, and use of satellite personal communications in thinly-populated areas. The Green Paper further sees that "personal communications will ultimately allow person-to-person calling independent of the location and the terminal used, the means or transmission (wired or wireless) and/or choice of technology." Flexibility in service provision, including the possibility to combine services offered via different networks and technologies in response to market demand, is seen as particularly important to enable movement in this direction.

Whilst noting Europe's generally strong positioning for development of personal communications, the Green Paper also highlights a number of barriers to market development, including:—maintenance of restrictions on entry and operation which constrain market development and prevent equality of opportunity for market participants;—market fragmentation, caused by different licensing arrangements in different countries and through awarding licences along the lines of radio system technologies (a consequence of frequency assignment methods);—lack of a common approach regarding service provision, in particular by independent service providers, which could provide flexibility to overcome problems of market fragmentation;—constraints on freedom to achieve economic mobile network operation, particularly regarding dependence on fixed network operators for interconnection and infrastructure;—lack of firm timetables for allocation of frequencies for key personal communications technologies.

Main Proposals

The Green Paper's major prescription for realising the goals and overcoming the barriers set out above is, unsurprisingly, to maximise commercial freedom and allow market forces to play a full role. A broad interpretation of the Green Paper's positions picks out the following as components of the regulatory regime proposed for mobile services:

Open Market

—Abolition of exclusive and special rights for mobile network operation, in essence requiring introduction of competition and non-discretionary licensing. The Green Paper states that the procedures and criteria for

award of licences should be fully objective and transparent, and that applicants should be treated in an equal manner.

The Green Paper does not recommend a method of awarding licences, but states that the method chosen should aim particularly at maximising benefits for users e.g., in terms of prices, quality, etc. It implies that licensing competitions (beauty parades or auctions) should be resorted to only where there is contention for available frequencies. It stops short of suggesting that regulators should leave determination of numbers of entrants to the market.

—Unrestricted entry into service provision. The Green Paper states that both independent service providers and mobile network operators should be allowed entry. It further states that mobile network operators should accept all reasonable requests from service providers (including those integrated with other mobile network operators) to deal, within the limits of normal commercial practice and competition law. It considers that service provision does not require licensing, however service providers should follow a self-regulation code of conduct.

—Mutual recognition. The Green Paper extends the principles of mutual recognition of national authorisations into the mobile area, in order to reduce barriers to entry in different countries. However, it points out that full mutual recognition of mobile network operator licences is only possible where there is no limitation on the number of operators. As regards service providers, it states that their established relationships with mobile operators should be fully recognised.

—Frequency availability. The Green Paper stresses the need to efficiently use frequency spectrum, to involve market participants in frequency planning and to publish clear and non-discriminatory frequency allocation procedures.

Level Playing Field

—Non-discriminatory licensing conditions. This includes abolition of special rights granting any player a lasting advantage.

—Safeguards in licensing to ensure equal treatment. The Green paper makes specific reference to the interface between mobile network operators and service providers. It considers that the licenses of mobile network operators should require sufficient transparency, in particular concerning accounting, to allow supervision of service provision activities which are integrated into their operations.

Freedom of Operation

—Minimum necessary regulation. The Green paper considers that regulation should be limited to what is justified in the general interest. It states that mobile

licensing conditions may set public service requirements concerning permanence, availability and quality of service, and should restrict activities only on the grounds of "essential requirements" such as the integrity of public networks.

- Free combination of service offerings. The Green paper sees as essential for development of personal communications the freedom for service providers to offer a combination of mobile services provided under different licences (in the same or different countries) and using different technologies. Come 1998, this freedom should be extended across both fixed and mobile areas.
- The Green Paper indicates that mobile network operations would as a normal rule be allowed to expand their mobile operations through bids for multiple licences. From 1998, mobile operators could bid for licences for provision of public voice via the fixed network, and fixed network operators could bid for mobile licences.
- Open interconnection. The Green Paper indicates that the principles of interconnection defined under ONP for access to the fixed network should be employed in the mobile area. Mobile operators should respond to reasonable requests for interconnection, with agreement reached primarily through commercial negotiation. They should be allowed to directly interconnect, both within and between Member States.
- Infrastructure. The Green Paper considers that mobile network operators should have rights to establish their own infrastructure or use that provided by a third party, subject to use for their licensed activities. They should also be able to share infrastructure and sites.

The implementation of these proposed positions is seen to involve some extension of EC directives, but mainly requires action to be taken by administrations and regulators at the national level.

EC mobile policy did not start with the Green paper (but could only get so far without it). Since 1987, actions have been taken in a number of key areas:

- Support for introduction of GSM, ERMES and DECT. In 1987, the EU Council of Ministers adopted a recommendation and accompanying directive promoting the coordinated introduction of GSM. The recommendation set targets for rollout and availability; the directive required Member States to make available the necessary frequencies. Subsequently, a similar dual measure approach was taken in 1990 for ERMES (digital radio paging) and in 1991 for DECT (digital cordless).
- Frequency coordination framework. In 1990, the Council adopted a resolution calling for CEPT wide cooperation on radio frequencies focused on the CEPT European Radiocommunications Committee (ERC). The ERC adopted a mechanism in 1991 for

implementation of 'ERC Decisions' which the EC Council subsequently said should be used in preference to EC frequency directives. The arrangements for cooperation between the Commission and the CEPT bodies concerned under this approach are being worked out. A similar framework is being developed for numbering.

- Introduction of competition. The Commission's competition directorate, DGIV, has acted to encourage a small number of Member States to license a second GSM operator.
- Mobile terminals. The first common technical regulations (OTRs) were adopted in 1993 as the basis for mutual recognition of type approval of GSM terminals according to the 1991 directive covering this subject.
- Research and development. The RACE mobile project (Research Into Advanced Communications in Europe) is carrying out research into a 3rd-generation UMTS system (Universal Mobile Telecommunications System).

Actions to Promote Development

A number of further actions at the European level are proposed to promote development of Europe-wide mobile and personal communications. These include:

- Completion of CEPT-wide frameworks for frequency and numbering coordination.
- Promoting Europe-wide introduction of key personal communications systems, such as DCS1800, UMTS and LEOs, via the setting of firm frequency allocation schedules and, for future systems, coordinated/Community-level licensing.
- Introducing a European numbering space for Europe-wide personal numbers.
- Establishing a code of conduct for service providers.
- Setting up an action programme to address concerns about health hazards and interference from radiocommunications devices and establish safety standards.
- Promoting standardisation to ensure interconnection and interoperability, including access to intelligent network functionality.
- Working out common positions with regard to non-EEA countries concerning provision of mobile and personal communications.

Conclusions

The mobile Green Paper shows that there is a lot more to mobile policy than simply licensing two operators in each area. It points, for example, to the structure of the sector itself and indicates a general requirement for greater flexibility.

The timing of the Green paper is just about right, coinciding with initial steps towards development of personal communications. This allows it to contribute some significant ideas concerning the future direction of European telecommunications, such as the emergence of the wholesale/retail concept—with service providers operating across the boundaries of network provision—as a major structure for the future supply of telecommunications services in Europe.

Its timing also allows it to take advantage of the recent policy success of the 1992 telecoms review, for example initiating the adaptation of ONP towards becoming a set of general regulatory principles applicable throughout the sector.

Overall, better late.

FRG Research Minister Calls for Information Superhighway Initiative

94P60257A Frankfurt/Main FRANKFURTER ALLGEMEINE in German 25 May 94 p 1

[Text] Bonn, 24 May. Germany and the European Union (EU) urgently need to take initiatives to expand information highways for multimedia applications of the future so as not to fall behind America and Japan in the competition. This was the conclusion of a conference among high-level representatives of business and science which was called by Federal Research Minister Paul Krueger.

Information highways refer to rapid, high-volume transmission networks which include such applications as video conferences, the individual ordering of movies or news, home shopping, or the exchange of data among computers for scientific and business purposes.

Krueger, Heinrich von Pierer (the chairman of Siemens AG), and Mark Woessner (the chairman of Bertelsmann AG) emphasized that Germany has good technical prerequisites for the multimedia services of the future. The network infrastructure is very good, Krueger said. Based on a study which his ministry contracted, however, Krueger pointed out infrastructure shortcomings which hamper innovations. There are gaps in the technical and organizational integration of the systems, in the development of specific software, and in the availability of services which do not utilize all the existing possibilities, he said. Krueger and von Pierer said that fees in Germany are too high in comparison with international norms. The Siemens head questioned whether the postal reform will change this situation. According to the study, the level of tariffs for leased services was three to seven times higher than in other industrialized nations. Deutsche Telekom contested this finding. Krueger specifically supported the demand by Professor Eberhard Witte (University of Munich) and the industrialists that more competition and deregulation was needed in the telecommunications infrastructure. Only then will one obtain an extensive array of services, low prices, rising investments, and new jobs in the telecommunications sector, they said.

In the conversations, concern was expressed that delays would arise which would be difficult to overcome if the Telekom's network monopoly were not be eliminated until 1998, as is currently planned. Krueger said that one must reconsider this situation in connection with the postal reform. Krueger, a CDU member, also pointed out that the agreement of the SPD would be needed for the reform project.

During the conversations, Krueger was urged to take an initiative in the field of data highways during the German chairmanship of the European Union (EU) in the second half of 1994. He agreed to do so. Von Pierer said that something concrete must be done in this area as soon as possible on both the German and EU level. As a first step, progress must be made in standardization on the European level. Moreover, there should be specific pilot projects. Thus the planned data highways between Bonn and Berlin should be rapidly tackled, Von Pierer said.

To open up the multimedia services, a change in the broadcasting law is necessary, said Woessner. The previous concept of broadcasting does not fit the new applications. When the broadcasters' state contract is amended, one must drop the previous limit, according to which a company may not own more than 49 percent of the shares of a broadcaster, said Woessner. Those participating in the conversation stressed that the large number of future television channels, which is controversial with the public, is only one of the new applications.

Developments in German Mobile Telephone Market Viewed

94WS0260B Frankfurt/Main FRANKFURTER ALLGEMEINE in German 8 Mar 94 p 13

[Text] A great future is being predicted for the mobile telephone. By the year 2000 around 10 million Germans could be mobile telephone subscribers. The entire telecommunications field should by then have a greater importance in the national economy than the automobile industry. Provided that the federal liberalization and the elimination of monopolies proceeds rapidly. And, not least of all, the natural, comfortable use of the mobile phone—that is, its development from luxury item into consumer good—should contribute to such rates of growth. At the current time, however, being constantly accessible [by telephone] remains a luxury. There are approximately 1.8 million mobile phone subscribers in Germany who treat themselves to this still costly freedom. It is primarily business customers then who are acquiring [phones by] the only two competitors currently in this market, the Telekom subsidiary DeTeMobil and the private Mannesmann Mobilfunk.

That is supposed to change in May when E-plus wants to start [operating]: this new company, under the management of Thyssen and Veba, was officially granted a license for a second private mobile phone network last May and was founded in April. New focus groups, like

the young, singles and regionally active business people, will be targeted. The goal of the newcomer is to conquer the mass market.

And without a doubt the structure of the market will change greatly with the entry of E-plus: the buildup of the network will be forced; the use of mobile phones will develop more quickly into a consumer good; the initially strongly regional company E-plus will bring about a change in the rate policies, also in those of the competition, and thus a mid-term reduction in price.

With the start-up of E-plus the market will finally be opened up. Since the new company does not want to present itself—next to DeTeMobil and Mannesmann Mobilfunk—as the “third in the alliance” of those who have been granted a lucrative license. E-plus wants to act. We can well be curious about the marketing mix. The suspicion that the two other licensees, to the detriment of their initial customers, are trying in a “secret alliance” to amortise their network as quickly as possible is unresolved. Customers can hope that when E-plus enters the market, then this often criticized “alliance” will break up.

If we look at the head start that DeTeMobil and Mannesmann Mobilfunk already have now with the build-up of the network and the acquisition of customers, then E-plus's strategy seems born of necessity. The past year and a half have shown that the market actually is growing more quickly than the optimistically intended forecasts made at the start of D1 and D2 predicted: for 1993 the two [service] providers counted on 300,000 to 350,000 subscribers. Nearly a million customers, however, were actually signed up by the end of last year. And the number increases daily by two thousand. The reason is first and foremost the unexpectedly large decrease in the price of the mobile phone. The strategy of the newcomer could thus bear fruit, although it will not be able to reach the profit zone until after the two established [companies]

The rapid development in the mobile phone occurs, however, in the face of increased competition which is to the detriment of some private providers of equipment and services. The price of the equipment has dropped dramatically, and it is here that the struggle for customers is already being waged. The calling charges are actually relatively stable. That leads to the “English sickness” in Germany, too: the equipment is to some extent sold below cost in the hopes that customers will be industrious about booking “air-time,” that is, will use the telephone. The success of this strategy is hampered by the high prestige value of the mobile phone. For many, the possession of this phone is more important than the telephoning, especially since that is very expensive. These customers, however, do not make the business profitable for the now 13 private service providers.

But also the three network providers are struggling with starting difficulties. The old burden of structural difficulties is giving DeTeMobil a great deal of trouble;

Mannesmann Mobilfunk cannot keep up with the high level of advertising activity by DeTeMobil, which is written off as cross subsidization by the parent [company]; and the newcomer E-plus must after all start out with high investment costs [coupled] with a simultaneous late start compared to the established competition. Since in spite of some still existing “phone service gaps”—the DeTeMobil and Mannesmann Mobilfunk networks already almost blanket Germany now—E-plus must make due at first with patchwork solutions. On the other hand, the start-up costs are lower than for the two D-networks operators. The costs for the infrastructure are estimated to be between twenty and thirty percent more favorable than in 1990.

The way to the mass market is, however, also being smoothed over by the newcomer. The new network is laid out in such a close-knit fashion that telephones can be used which have a substantially lower transmitting power than the phones in use up until now, which also means the batteries will last longer. And the smaller and more compact that the telephones are, the greater will be their acceptance by the public. Experts predict that in a while around 90% of the end units will be pocket models.

When all networks are so built up that units with low transmitting power are sufficient, the decisive [factor] in the market success of the product will no longer lie with the technology of mobile phones but rather and especially with the marketing and thus also with the price. The Pan-European digital GSM standard does not permit a great deal of differentiation. If the price over the mid term approaches that of the [landline] network, however, it will become clear that mobile communication offers not only a complement by rather an authentic alternative to location-bound telecommunication. Only then will the mobile telephone enjoy the future which is being predicted for it.

German Railways, Bundeswehr Use Own Telecom Systems

94WS03044 Duesseldorf VDI NACHRICHTEN
in German No 13, 1 Apr 94, p 13

[Article by Gerd Krause: “German Railways and Bundeswehr Do Not Use DBP Telekom: Special Communications Networks Are a Specialty of Stuttgart's Alcatel-SEL: New Railway System Is ISDN-Capable for Digital and Analog Connections”]

[Text] VDI-N, Duesseldorf, 1 April 94: Instead of using the DBP Telekom system, power companies, the Bundeswehr, and the German Railways have their own communications systems. Alcatel-SEL in Stuttgart, which has installed much of the network, calls this developmental field “special networks.” The company's know-how is now beginning to pay off. Such special networks are becoming an export hit for the Stuttgart enterprise.

John Doe is not the only person who likes to chat on the telephone. Military personnel and railway workers also have frequent recourse to the telephone. This occurs in

the course of their normal duties, but with a significant difference. While Mister Average Citizen, providing he or she is not telephoning via a private D2 mobile system, as a customer of the DBP (German Federal Post Office) Telekom, uses the postal service's line system, the military and the railway employees enjoy a privilege. In addition to the power companies (EVU) and the former Federal Railway System, the armed forces are also exempted from DBP Telekom's telephone service monopoly. These three user groups can operate their own systems for internal communications traffic, i.e., the railways, the Bundeswehr and the power companies have their own communications systems. Alcatel-SEL in Stuttgart, which has installed most of these systems, calls them "special networks." "Special networks," as Wolfgang Dietze, the director of the special network systems, defines them, "serve all of us, although they do not belong to the Telekom's public communications system."

The German military is especially ambitious. In order to be independent of the public infrastructure, the Bundeswehr decided to build its own communications system. Alcatel-SEL had proposed a single system for the military, but the Luftwaffe, the Navy, and the Army could not agree on a common system. Each branch of service wanted its own. Consequently, in 1989 SEL installed a nationwide system with 6,500 connections for the Bundeswehr and another nationwide special network with 40 large exchange centers specifically for the Luftwaffe. The eccentric Navy chose a wireless system. At taxpayer's expense, Fleet Command ordered its own directional radio system from the Stuttgart company.

The know-how gained by the Stuttgart workers in developing these systems is now becoming an export hit. The technology underlying the special networks is the Alcatel 1000 S12 System, which had been developed for public communications use and which is used in Germany and in many other countries of the world by DBP Telekom. To date, Alcatel-SEL has built special networks for the armies of Thailand and Saudi Arabia, and last year the Swiss Railways received a modern integrated service digital network (ISDN) with 480 exchange centers. The modernization of the Chilean railways system with 30,000 connections promises to be a most impressive contract.

An actual contract is the new nationwide ISDN-network for the German Federal Railways—the former State-run Bundesbahn and Reichsbahn. This project has been underway since July 1993 with Alcatel-SEL as the consortial leader. Alcatel-SEL delivers the lion's share of the entire switching technology, while the group consisting of Siemens, ANT, and Alcatel-SEL delivers most of the transmission technology.

As compared with public systems, special networks are small. The most common definition, advanced by Wolfgang Dietze, puts the number at up to 200,000 connections. The technology may be seen in the example of the German Railways system. The performance features—

complete ISDN capability—are not limited to local exchanges, but are available throughout the network, mostly for subscribers with digital and analog connections. Thus, for example, at any location in the rail system a nationwide conference call capability (add-on third parties) with ten subscribers can be established. Other performance features are preset transfers in the case of a busy connection, automatic recall, multiple numbers, secret numbers, and the setting up of closed user groups. In addition, digital subscribers receive other performance features like telephone number indicators, call units indicators, or equipment selection with select terminal number.

The compatibility of the special networks with analog and digital technology is one of their strongest performance features. All kinds of switching technologies can be used in an exchange center. Connections can be made with digital and analog technology, even the public exchange technology can be hooked up. The modular construction permits the system to be expanded gradually, so that the network, as originally planned, can be extended to several subscribers if necessary.

In future, the German Railways system could become of interest to the telephone companies. The telephone monopoly in the countries of the European Union ends in 1998 and, according to the Wolfgang Boetsch, the German Minister of the Postal Service, the network monopoly will no longer be able to be maintained. For the German Railways, this will mean that its nationwide communications system could be opened up to private customers. At any rate, Dietze emphasizes, it would become technically possible to do so. Thus, for example, a customer in Duesseldorf could select the railways exchange via his local Telekom system, be switched to Hamburg through the railways system, and speak to the other party on the Alster on the local Telekom system there. Since Alcatel-SEL has selected the internationally standardized Nr. 7 signalling procedure for the special network, the transition to the public system would easily be possible. "Technically," Dietze asserts, "everything is in place." The 34 Mbit/s transmission capacity of the fiber glass cables excludes the possibility of any bottlenecks developing, while the exchange facilities can be expanded on a modular basis.

The German Railways' new extensive system is entirely comparable to the Telekom system as far as extensive interconnections are concerned. But it is smaller, having been initially designed for only 120,000 subscribers, while about 42 million now subscribe to Telekom's system.

In the first phase of its system expansion, the Railways is installing network nodal centers, which are comparable to small regional networks, at 44 sites. In turn, at out 100 terminal exchanges are attached to them. Even the expansion process is similar to that of the postal system. The Railways system consists of both fiber glass lines and directional radio. In general, the fiber glass cables

run underground along the left and right sides of the track for a total of over 30,000 km.

Germany: 29-32 Billion DM Market Expected in Multimedia Area

94P60190A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 17 Mar 94 p 8

[Unattributed article: "Telecom Expects a Billion-DM Market By the End of the Century"]

[Text] Telecom Services expects double-digit growth this year in the promising multimedia area. The business-customer section will grow by 12 percent to around 29 billion DM, and private sales will increase 10 percent to 32 billion, said members of the board Horst Gellert and Dieter Gallist at the CeBIT in Hannover

In the future, not only voice, but also images, data, and video will be transmitted over data lines. "The multimedia area, in which 300 million DM is now invested in Germany, will be worth 7 billion DM by the year 2000. Sales will also increase 24-fold," said Gellert. Telecom wishes to have a healthy share of this growth.

Among business customers, Gellert is placing special emphasis on ISDN in addition to the traditionally largest business area of telephone services. Telecom can become the world leader in introducing this future technology with more than 1.2 million B-channels sold.

ISDN sales rose more than 130 percent to 2.5 billion DM in 1993. An increase to 3.7 billion DM is anticipated for 1994. In the future, ISDN should become available as a high-performance data net for communication among personal computers. To date, few personal computers have been holed up to the telephone net in Germany.

More and more, telephone connection will become a universal telecommunication medium, said Gallist. In the future, stationary and mobile telecommunications will grow together. "Every customer can be reached through one telephone number even during this decade, whether he is telephoning from a mobile or stationary set," says the telephone executive. The most important customer among private sales is a telephone service with approximately 30 million customers and with planned sales of 25.4 billion DM this year.

Telecom also expects good business through interactive television. The feedback channel of customers for program requests will be telephone connection. The Pay-TV-Market also offers enormous potential. The number of subscribers will increase from 760,000 to 3.4 million by the year 2000.

France Telecom Fiber-Optical Refit Outlined

BR1104144594 Paris ELECTRONIQUE
INTERNATIONAL HEBDO in French 31 Mar 94 p 11

[Frederic Fassot report: "France Telecom Switches the Core of the Public Network to an 'All-Optical' Configuration"]

[Text] France Telecom recently unveiled its plan for modernizing the French switched telephone network (STN) that was launched three or four years ago. While the public operator does not envisage any significant increase in its investment budget for this task (each year it plows in 20-25 billion French francs [Fr] out of a total budget of Fr30 billion), the technological choices that have just been announced, however, do threaten to change the list of the company's registered suppliers. This is a game of musical chairs whose stakes run into billions of French francs, since, for example, each year France Telecom spends around Fr4 billion on transmission equipment and Fr6 billion on public network switching.

The French public network, with the highest proportion of digitization in the world (85 percent in switching and 90 percent in transmission) will therefore undergo massive change. The changes announced, however, only concern the core of the network (the transmission network) which runs from the five main transit switchers to the 13,800 local centers. On the other hand, there should be no changes in the short-term for the distribution network, i.e., the links between the local centers and the 30 million subscribers, which represent between 40 and 50 million connection lines. Thus, the changeover to an "all-optical" configuration does not directly affect the subscriber and does not therefore herald a possible "information highway."

National Network Cabled in Optical Fiber by 1996

However, far-reaching changes have been announced for the transmission network. Firstly, these changes could enable it to handle the massive increase in traffic generated by the decision to cable the distribution network with optical fiber to the door of the subscriber. Secondly, these changes affect all the network functions: switching (all switches will work by time-division switching by 1998), transmission, and signaling (where the network is controlled by the transmission of commands between switches), without forgetting network supervision (administration and technical management).

The greatest challenge concerns transmission, with the generalization of SDH (synchronous digital hierarchy) technology and optical fiber: by 1998, the structure of the France Telecom transmission network will be almost exclusively cabled with monomode optical fiber, and as a result, coaxial cable and Hertzien links will be dropped completely for this purpose. At the end of 1993, the national network included some 12,000 kilometers of optical fiber cable, with 22,000 km on the associated regional networks. This represented a total of 820,000

km of monomode fiber (since each cable can now carry an enormous number of fibers). This figure will reach 1.3 million in 1996 when, with 21,000 km, the national network will have been completed, while the total length of the regional networks will be 43,000 km. By the year 2000, two million kilometers of optical fiber should be in service, with 80,000 km of cable for the regional networks. These are mouthwatering prospects for Alcatel and the SAT [Societe Anonyme de Telecommunications], which have been selected to supply optical fiber. However, where SDH equipment is concerned, it is harder to spot the eventual winners. The adoption of this technology, which today makes it possible to transmit at a speed of 2.5 Gbits/s down a single fiber (the equivalent of 30,000 telephone lines) and 10 Gbits/s in three or four years' time, will lead to a complete reconfiguration of the network architecture from an arborescent structure to a structure of regional loops (about 100) connected up to five major national branches, or, to use the France Telecom term, petals. This loop structure will thus ensure dual network access at all levels so that, if an incident is generated on the loop it will be possible to automatically reroute the traffic along the second branch of the loop.

Suppliers to be Chosen Before the Summer

The first 2.5 Gbits/s-per-fiber petal will be looped up in the autumn of 1994 (in eastern France, followed by the north). By then, the suppliers will have to be chosen. The first choice concerns the I/O multiplexors which make it possible to catch data "in flight" at different transmission speeds without demultiplexing, and then inject them into the 155 Mbits/s loop. Each loop should have three to four multiplexors (or around 400 systems in total). A number of groups are competing on this market: Alcatel, the SAT in partnership with Siemens, Secre in association with the Israeli company ECI, Nokia, and TRT-PKI (Philips). Suppliers could be selected within a few weeks, although Jean-Pierre Poitevin, director of the public network, warns: "No one is today capable of meeting the specifications promised on paper." Then the suppliers of the SDH patch bays (which do the actual switching) will be chosen. Alcatel and the SAT have already been selected to supply the 2.5 Gbits/s point-to-point transmission line systems on the petals.

A "Programmable" Network for Dedicated Links

The other major innovation on the public network concerns dedicated links. Until now, these links have been permanent and built at the request of companies for the transmission of their data. However, to reduce service costs by eliminating some of the civil engineering costs involved in link connection, France Telecom has recently decided to build a separate network for dedicated links. Christened MDTN (multiservice digital transport network), this network will be fully precabled in optical fiber. A connection is then made by programming it in, the physical link being already in place. This technique of optical fiber precabling is also starting to be used to build FOC's (flexible optical connections) for

major professional customers and densely-populated business districts. Already, some 200 buildings have been cabled in the Defense business district of Paris, offering high-thruput services (up to 34 Mbits/s). In 1998, 1,500 buildings will be cabled, and France Telecom has also examined the possibility of cabling 5,000 additional buildings. Lastly, network control, or signaling, will also be considerably modified. Initially, the data required to control the network (the status and availability of equipment, billing, etc.) were exchanged over voice links. From now on, the Semaphore signaling network will be kept separate from the voice network to increase the data exchange capacity required by the proliferation of new services such as the upcoming capacity to transmit messages in the course of a communication, or to identify the incoming call number—services which could thus open up new markets for terminals.

In fact, the general network will consist of four networks one on top of the other: the voice and Semaphore networks, but also an "intelligent" network and the technical supervision network. Thanks to the "intelligent" network, new services could rapidly be developed simply by altering the software in the centralized database—service modifications could even be done in real time! As a result, certain instructions will no longer be programmed into all network switches, but will instead be placed in the central database which the switches would then consult. This will greatly simplify the technical management of the telecoms system.

France Telecom Favors European Approach to Information Superhighway

94WS0294B Paris AFP SCIENCES in French
31 Mar 94 p 13

[Unattributed article: "Information Superhighways: France Telecom Favors European Approach"]

[Text] Paris—The rapid development of information superhighways "requires a voluntarist European approach" that will not necessarily be consistent "with the will for accelerated deregulation that is desired by some people in Europe," said Marcel Roulet, president of France Telecom, in an interview published in LE FIGARO on 28 March.

"The market is not leading automatically to the development of information superhighways," Roulet added, emphasizing that the development of Minitel in France demonstrates that "a political will" is also required.

When questioned about the announced privatization of the Belgian telephone company Belgacom, the president of France Telecom suggested that France Telecom might be a candidate, explaining that he is hoping for the "widest possible development of partnerships among European operating companies." He added, however, that "the stand taken by European authorities will be the determining factor in that trend, and it would not be in

Europe's interest if alliances only with non-European operating companies were possible for Belgacom."

Lastly, Roulet reaffirmed that his objective is to get his group out of debt and reduce its financial costs to less than 3 percent of turnover by 1998, that being the year when all telecommunication services in the European Community will be opened up to competition.

France: Alcatel's Long-Range Plans Presented

Alcatel Optronics

94WS0305A Paris L'USINE NOUVELLE in French
31 Mar 94 p 26

[Article by Jean-Pierre Olivet: "Alcatel Restructuring Its Optoelectronics Forces..."]

[Text] *Optoelectronic components are strategic for many of the group's subsidiaries. The world's number one in telecommunications is federating its optical activities, thus preserving its technological independence and making its entry into the free marketplace.*

Alcatel's optoelectronic components are now prospering and are highly regarded. The group is combining its activities and creating a specialized subsidiary, Alcatel Optronics. The new company will employ 290 persons and has set its goals at a revenue of 250 million French francs [Fr] and a sales growth of 20 percent in 1994.

A streamlining had become indispensable. The group's capabilities had become numerous and too dispersed. Alcatel-CIT is a major player in underwater communications system components. Several of its Marcoussis Research Center laboratories are highly reputed for their developmental work in optoelectronics. Its German subsidiary SEL has been active in this sector for many years.

Based at Nozay, in Essonne, Alcatel Optronics will be responsible for the group's activities in the development, manufacturing, and commercialization of optoelectronics components. Its ultramodern plant will produce the active components (lasers and photodetectors) whose production until now has been split between its Marcoussis and SEL's German plant sites. The latter will henceforth concentrate on passive components (multiplexers), while the Lannion plant will do the assembling and testing of products designed for underwater use.

In thus bringing all of its skills in this sector into a single entity, Alcatel affirms the strategic nature of optoelectronic technologies. Alcatel's president, Pierre Suard, has always kept a close watch over the group's technological independence..., especially in its core specialties. With optics becoming the heart of telecommunications, Alcatel, the world's number one in telecommunications finds it unacceptable to be dependent upon American and Japanese suppliers for its needs.

Alcatel Optronics will supply the needs of the group's other subsidiaries in the fields of transmission (Alcatel-CIT, SEL, Telettra, Alcatel Network Systems) and, tomorrow, switching (Alcatel Bell and Alcatel-CIT). "Our objective is to cover the quasi-totality of the group's needs, versus the half that is currently being covered," says Philippe Bregi, Alcatel Optronics's commercial and marketing director.

20% to 30% of Sales To Be Outside of Group in 5 Years

Beyond its captive markets, consisting of the group's subsidiaries, the company has decided to enter the world market in optoelectronic components for telecommunications, thus positing itself as a challenger of AT&T, which currently has 15 percent of the world market, and Japan's NEC, Hitachi, Fujitsu, and Mitsubishi (between 10 and 12 percent), and finds itself running neck and neck with Hewlett Packard (8 to 10 percent) and outdistancing Ericsson and Northern Telecom (5 percent each). In the minds of Alcatel Optronics's management, the objective is clear: Within 5 years, 20 to 30 percent of its sales must be outside of the group. This will double its revenue.

In the optoelectronic components sector, as in that of conventional semiconductors, one of the factors making for success is large-scale production.

Nozay's Production Capacity To Be Quintupled

In April, the first optoelectronic components will be rolling off of Alcatel Optronics's ultramodern Nozay plant's production lines. Although its capacity is still being kept secret, the unit's 6,000 square meters—with its 140 employees—is virtually certain to enable the company to quintuple its present production rate. For this site, with its Class-100 clean rooms, the engineers have chosen a process using slices of organometallic compounds (InPAsGa) 50 mm in diameter instead of the 12.5 mm wafers previously used. This will enable the manufacture of 12,000 lasers on each slice. After being produced, assembled, then tested, these laser semiconductors, photodetectors, and optical amplification modules will be used in fiber-optic transmission systems, both terrestrial and underwater. The components that will constitute the heart of the optical PABX's, on which the group is currently working, will also be produced at Nozay.

Joining Globalstar Services

94WS0305B Paris L'USINE NOUVELLE in French
31 Mar 94 p 26

[Article by Jean-Pierre Jolivet: "... and Joins Globalstar"]

[Text] *Alcatel is positioning itself for the telecommunications of the third millennium. The French group will be among the number of investors in the future satellite communications system Globalstar*

Seated together with the American firms Pactel and Qualcomm, Italy's Alenia, Germany's Deutsche Aerospace, Great Britain's Vodafone, and Korea's Dacom and Hyundai, at the 1.6-billion-franc [Fr] round table being hosted by the American firm Loral (35 percent), Alcatel is contributing Fr200 million for an 11-percent share.

The project, whose total cost will exceed Fr10 billion, calls for using 48 satellites in low orbit. Globalstar will offer voice and data transmission, telescopic, and location and tracking services, all to be accessible by fixed and mobile terminals from any point on the planet. It is expected to be operational in 1998 and to have 10 million subscribers within 10 years from then.

Alcatel, the world's number one in telecommunications, could not afford to remain on the sidelines in the face of the large-scale alliances that are being forged. Satellite networks are one of the stakes in the mobile telephony battle of the coming years. Motorola has rallied some 20-odd groups worldwide around its Iridium project. Microsoft and McCaw Cellular have recently announced their Teledesic project.

By joining Globalstar, the French group is strengthening the American positions it has already gained by way of joint ventures. Since 1991, Alcatel has been working together with Loral within its subsidiary Space Systems/Loral, in which Alcatel acquired a 49 percent stake together with Italy's Alenia. Alcatel also operates a company, Eutetrac, which it owns jointly with Qualcomm, in the satellite locating and tracking sector.

Industrially, Alcatel will be responsible for designing and producing the payloads to be carried aboard Globalstar satellites. These amount to 45 percent of the cost of the satellites, and their production will be spread over a period of four years.

This will ensure an ongoing workload at Alcatel's Toulouse plants at a time when orders from European manufacturers are at a low ebb.

Major Projects Worldwide

Globalstar: 48 satellites to be launched into orbit beginning in 1998. Loral and eight groups will invest Fr10 billion.

Iridium: 66 satellites to be in service beginning in 1998. Motorola and 20 groups will invest Fr20 billion.

Teledesic: 840 satellites to be in service beginning in 2001. A joint Microsoft-McCaw Cellular project at an estimated cost of approximately Fr52 billion.

Odyssey: Under preparation by TRW.

P21: Under preparation by Intelsat.

Swedish University Develops Transistor Operating at 380 Gigahertz

94WS0296A Stockholm NY TEKNIK in Swedish
24 Mar 94 pp 14, 16

[Article by Ulla Karlsson: "Ultrarapid Transistor Raises Band Frequency to the Highest Level;" initial paragraph is NY TEKNIK introduction]

[Text] The key to the communications network of the future exists at Chalmers. An extremely fast transistor which becomes the building block of tomorrow's wireless communications system. It opens the door to an infinity of unutilized frequency bands, band which all lie above 20 gigahertz, where one will be forced to communicate in the future.

A transistor which works at a frequency of 380 gigahertz. That is the result of eight years of research at Chalmers Institute of Technology in Goteborg. Here is one of the world's best research groups on high-speed electronics. A group which during the last six years has created 10 generations of the fastest transistor type HFET (Heterostructure Field Effect Transistor). HFETs which through new material combinations and refined lithography methods (methods of writing the pattern lines from which circuits are made, have become increasingly faster with each generation.

380 Gigahertz

"A few months ago we arrived at limiting frequencies of 380 gigahertz," says Herbert Zirath, a researcher at the department for microwave technology. "I did not think that was possible a few years ago."

These rapid transistors can now become the solution to a problem that is difficult to solve in today's communications society—the lack of frequencies. Because regardless of how blue the sky looks, it is jam-packed with carrying frequencies. Frequencies which bring television images, radio, mobile telephones and a great deal more. Up to 1 gigahertz it is really crowded, then it thins out a little, after which an ocean of free frequencies spreads out above 20 gigahertz. This is where international standards organizations now want to place the links to the mobile communications networks of the future, wireless local data networks and new services such as video on demand. But that is easier said than done. Completely new high-frequency components that can be mass produced and new monolithic circuits are needed in order to develop circuits which work in the millimeter wavelength range.

This is where the transistor at Chalmers enters the picture. With the transistor as a building block new circuits for communication in the gigahertz range have already seen the light of day. Among them are, for example, a hybrid circuit in which the researchers have used an HFET as a resistive frequency mixer up to 120

gigahertz. This is something they alone in the world have achieved. Other research groups have only achieved 35 gigahertz.

The mixer is part of a whole family of circuits which the researchers are now working with, a family which together will create a combined sender/receiver for the 55-gigahertz frequency. It would, for example be possible to use it as a digital radio link connecting base stations in a future telephone net. Here the researchers are working with Ericsson Radar and with financial support from Nutek.

Even Higher

The Chalmers researchers are also moving even higher up in the frequency range. On behalf of the Swedish Space Corporation they are developing an HFET-based receiver for radioastronomy. It is to work in the 119 gigahertz frequency and be installed in the Swedish satellite Odin, a satellite which according to plans is to be launched in the year 1997.

Compact Design

But if equipment for satellites can be permitted to be expensive, the same does not apply for equipment to be used publicly. Instead, it involves compact design in combination with large volumes, which in turn result in low prices. The Chalmers researchers, together with researchers at the University of Michigan, have found a solution to that problem. As the first research group in the world they have integrated a slot aerial with an HFET mixer and a lens.

Monolithic Integration

The group is now working intensely on integrating transistors and circuits on one and the same semiconductor chip, so-called monolithic integration. Through the integration it will now be possible to generate and amplify signals on the same circuit, something which in turn makes it possible to build a monolithic amplifier on a single chip. Yes, perhaps even with a combined sender/receiver on one chip. This in turn yields compact equipment and the possibility of mass production, with lower prices as a result.

"While manufacturing the HFETs we have today arrived at more than 90 percent flawless circuits. And that is what is needed in order to manufacture integrated circuits," says Herbert Zirath.

A High-Frequency World

The fast transistors which have been developed at Chalmers Institute of Technology can be used for the following, among others:

- Radio links which can be used for telecommunication in cities where fiberoptics are difficult to install (60 GHz), communication systems for cars and trains and wireless data networks in offices.

- Radar applications as intelligent speed controls in cars (77 GHz), three-dimensional images of radar targets, landing systems for aircraft during poor visibility (94 GHz) and phase-controlled antennas.
- Instruments such as receivers with low intrinsic noise for radioastronomy (119 GHz).
- Fiberoptic communication with a speed of 40 gigabits per second. The transistor can then be used to build laser modulators, optical receivers and circuits which pick out the clock concealed in the bit stream.

New European ISDN Standard, Future Prospects Viewed

94W80281A Düsseldorf: WIRTSCHAFTSWOCHEN in German 18 Mar 94 pp.127-127

[Article by Markus Schnurpfeil: "Avalanche Triggered in Digital Communications: Europe's ISDN Standard Throws the Communications Market in Full Swing"]

[Text] Horst Gellert, normally a low-key manager, permitted himself to voice some uncharacteristic emotional words. "A new milestone in the long history of communications has now been reached." And the business director of Telekom, the German Post Office Department's commercial affiliate, exclaimed that "a new age for reckoning time has begun, namely, before ISDN and after ISDN."

The reason for Gellert's glowing words was clear. Network users in 20 European countries celebrated the official introduction of the European Standard for ISDN (Integrated Services Digital Network) with a communications party. While up to this point the digital networks in Europe had operated on the basis of interim national standards, the bits and bytes now race through the copper wires and light waveguides on the basis of the European Unified Norm (abbreviated E-DSS1).

Network operators and the communications industry hope to receive the same effect from the Euro-ISDN that was received from the GSM-Standard—the technical regulatory structure for digital radiotelephony. The simple formula for success lies in the fact that a unified Euro-Standard creates a large sales market for end products, while the high volume of items pushes the prices down, which in turn attracts additional users. As Gellert effusively puts it: "With this development, the old world takes its place at the top of an advanced technology par excellence and can now harvest the economic uses from it."

But the Telekom-man will have to be a bit patient. In the short term, Euro-ISDN is highly unlikely to find the same dynamically growing demand for its products as was realized in the mobile radio business. Volker Fink, Telekom's technical director responsible, among other things, for ISDN marketing, states soberly: "It will take a year before the effects of the common Standard will be noticed in the market."

Fink's evaluation is totally realistic for the simple reason that all the essential elements in the ISDN picture blend

together very slowly. Only the beginnings of a large end product market now exist. To date, digital communications connections have only been properly marketed in Germany, where Telekom has expanded the ISDN network, at least in the former FRG, and has sold more than 300,000 so-called ISDN bases and about 20,000 primary multiplex connections for linking up large communications facilities. The trend is for further strong increases. Fink notes: "The other net operators have yet to trigger a similar development."

At any rate, the communications companies are working toward that end. "The European network operators are determined to move the Euro ISDN forward," Eckhard Oberfrank, ISDN specialist in the Dortmund office of the ExperTeam Telecom consulting firm, observes. Still, not all the obstacles have as yet been removed. "One of the bottlenecks," Oberfrank laments, "is the fact that the producers in each European country still need their own country's approval to have their products, like Fax machines and modems, connected to computers."

This is not only time-consuming, but it is expensive as well because of the necessary approval fees. The tedious approval procedures have had a definite effect on product price, especially in the case of simple Euro ISDN telephones. As one specialist in the industry notes: "In the case of the telephones, every additional cost added affects the price the consumer must pay."

Such adversities do not dampen the enthusiasm of the Euro ISDN champions however. "The Standard has triggered an avalanche that continues to gain momentum," Martin Storp, marketing director at Philips Communications Industry AG in Nuremberg, is pleased to report. He believes that the producers of equipment for digital communications are "finally on the way to profitable mass production with the concomitant favorable effect on end product prices." Industry specialists estimate that in four to five years, an adapter card for the PC will cost only 80 German marks [DM]. Storp observes further that "each PC will then be able to participate in telecommunications." At least DM500 would have to be invested today in order to be able to use this additional capability.

Despite the Euro Norm, however, no further large price reductions can be expected for medium and large communications facilities. The sharp competition, which companies like Siemens, Philips, Alcatel SEL, and Tele-norma have brought to this market segment in recent years, has already pushed the prices for large systems

well below the profitable level. "There is no more room for maneuver in that regard," Storp laments.

But the situation vis a vis small Euro ISDN systems is quite different. Telekom's Volker Fink recognizes that "there is a considerable need for action in the matter of small businesses and the self-employed." Although not connected to large production figures, the price spiral downwards continues markedly for smaller systems. With the Eumex minisystem, which manages up to eight extensions, Telekom brings to the market a Euro ISDN switching system at the competitive price of less than DM1000. Pleased by this Telekom development, consultant Oberfrank notes that "previously a terminal adapter, which could only connect a single analog telephone to the digital network, had cost that much."

And developments in other companies are also brightening the scene. Software giant Microsoft, for example, has now designed its successful 'windows for work-groups' program with a software module for access to the ISDN network. Oberfrank is convinced that this would never have happened if purely national ISDN standards still prevailed.

Despite these promising business prospects, the high spirits prevailing among the suppliers of ISDN circuit boards for personal computers, like AVM GmbH of Berlin, mbp Software & Systems GmbH of Dortmund, and ITK GmbH of Dortmund, are clouded. Regardless of the unified regulatory system, industrial policy 'trench warfare' threatens this lucrative market segment. It is being fought out at the technical level. With the so-called CAPI (Common Application Programmable Interface), almost all the producers of ISDN PC cards and communications software are now able to combine the hardware and the application programs of the various suppliers. A Euro ISDN version of this industry standard is already available.

However, mainly because of massive French influence and insistence, another, clearly technically inferior solution is being pushed along at the European standardization institute ETSI in Nizza. "Now that we finally have the European ISDN Standard, the French have nothing better to do than block the open market and try to protect its own industry."

The ISDN boom in Germany is clearly indicated by the number of base connections sold yearly. In 1991, 59,071 such connections were sold, in 1992, it was 138,831, in 1993, 281,254, in 1994, the number is expected to be 480,000, and in 1995, 800,000.

DEFENSE R&D

Czech-Slovak-Hungarian Robotic Reconnaissance Plane Developed

94P60161A Bucharest STIINTA SI TEHNICA
in Romanian Feb 94 pp 4, 5

[Excerpts] It seems inoffensive but it isn't. It seems to be a toy plane, but surely it isn't that either. It could be everything but a component of the modern warfare arsenal, and, still, the robot plane SOJKA-III TV, a recent Czech-Slovak-Hungarian joint development, is partly just that. It is not inoffensive because, in fact, this aircraft represents a fighting technology of mainly offensive characteristics. [passage omitted] It could (if needed) carry 20 kg of explosives. [passage omitted]

The Czech-Slovak-Hungarian robot plane can be used for peaceful applications also. Thus, SOJKA-III TV will be capable of performing aerial mapping, harvest status evaluation, damage assessment following natural disasters, radiation measurement over nuclear power stations and chemical detection over polluted industrial areas. [passage omitted]

Designing the craft began in 1988. The prototype performed its maiden flight in 1990. Experimentation with it continued in 1991. This robot plane is only one of the elements belonging to the reconnaissance/hit (battle) group. The other elements are: mobile control and information processing station, launching installation, meteorological field unit, special auto-support and recovery vehicles.

The group's navigation and guidance system is installed partly on the aircraft and partly on the mobile control and information processing station. The aircraft is provided with an automatic pilot, which ensures the plane's navigation and "piloting" on the prescribed course. On the plane's board are also: a transmission/reception station, a telemeter (distance measuring device) and a video camera.

The mobile control and information processing station displays flight parameters and the craft's course on the electronic terrain map, updated through information relayed by the video camera and the craft's other sensors. All information may be recorded as well.

The reconnaissance, as well as all the robot-plane's other sensors may be replaced as adapted to mission specifics. To this end, the builders had provided the craft with a wide range of devices to be accommodated within the 64 cubic decimeter space on board for this purpose.

SOJKA-III TV may fly on a preprogrammed course or it may be remote-controlled from the ground. The craft, according to its main performance characteristics—shown below—can be considered superior when compared to a relatively large variety of this type found in modern military arsenals. Other characteristics, qualities, performance or even "weaknesses" have not been published. With this type of technology these could be very important. Whatever else it might be said, the five Czech-Slovak and the eight Hungarian firms that collaborated in developing the group, under the guidance of military specialists, produced a military technology indispensable to modern warfare.

Wingspan	4.1 m
Length	4.125 m
Weight	130 kg
Engine power	31 kW
Flight autonomy	3h
Range	50 km at 600 m, and 100 km at 2,000 m
Cruising speed	120-180 km/h
Maximum speed	230 km/h
Flight altitude	50-2,000 m
Useful load	20 kg.

Hungary: All Terrain Light Military Vehicle Developed

94P60188A Budapest HVG in Hungarian
12 Mar 94 p 19

[Text] "Szoeske" (Grasshopper) the fantastically baptized all-terrain light military vehicle has been developed, based on the similar American vehicle's success in the Gulf War, at the private company of Laszlo Jeno, a former department chief within the military industry establishment. A component of the MP's (Hungarian Army's) long range planning, the development will go into series production not earlier than 1995. MH approved the plans—selected through bidding—in 1991. The 40-employee Gepfiet company built the first prototype at a time when Laszlo Jeno was still state secretary in the defense ministry. "Presently", Laszlo Jeno informed us, "the firm is building three more prototypes equipped with diverse options." Then he added: "in my estimation this all-terrain vehicle with a Volkswagen engine, fit also for civilian use, would cost at today's prices from 2-to-3 million forints." According to Army experts, development of the prototype had cost 6 million, while Laszlo Jeno estimates all development expenses to be around 30 million forints; 40 percent contributed by his own company, 20 percent each by Raba, Malev and Technoimpex, the owners of Gepfiet, and the rest from credits.

TELECOMMUNICATIONS

Cyprus: Telecommunications Authority Improvements

NC2504113794 Nicosia HERMES INTERNATIONAL
in English Spring 1994 p 107

[Article by Filippou Vasiliotis, general manager of the Cyprus Telecommunications Authority: "High-Tech Cyprus Networks the World"]

[Text] Due to its geographical location Cyprus has often been considered as a stepping stone between Europe, Asia and Africa and has for thousands of years been a meeting place for people living and travelling in this part of the world.

The island's geographical position assumes an even greater importance nowadays. Enhanced by the excellent telecommunication services offered by the Cyprus Telecommunications Authority (CYTA), as well as by other, specialised services offered to the business community, offshore companies and businesses have been attracted to Cyprus and the island has established itself as the most attractive business centre in the region and a telecommunications centre of advanced technology.

It is widely accepted that no contemporary business enterprise can be successful in today's demanding business world without efficient, advanced and reliable telecommunications facilities.

Recognising this, the Cyprus Telecommunications Authority has invested heavily in upgrading the telecommunications network, enhancing the quality and expanding the range of services offered to satisfy the growing needs of its customers.

The result has been the establishment of an excellent telecommunications infrastructure and the provision of reliable and efficient telecommunications services both nationally and internationally.

In Cyprus, the contribution of telecommunications in the general effort to reactivate the economy after the tragic events of 1974, has been particularly significant.

Subscribers in 197 countries, or about 99% of the world's telephones, can be accessed automatically from Cyprus, while the rest of the world can be reached through the operator. Telefax service is available to all countries operating such a service, while telex and telegraph services are provided to virtually every country in the world. New value-added services, such as audiotex and videoconferencing have been recently introduced.

Data transmission locally or overseas is effected either through the public, switched telephone network and point-to-point leased circuits, or via the Packet Switched Public Data Network (CYTAPAC), which uses sophisticated switching technology and ensures reliable and secure transfer of data. Private leased circuits are also available for voice, text and video applications.

A cellular mobile telephone service, operating at 900 MHz, with an area coverage of more than 90% of the island, and an island-wide automatic radiopaging service are also offered.

CYTA also provides a range of maritime services, enabling communication between land-based establishments and ships at sea, as well as a variety of services and facilities to third parties.

The authority, in its continuous drive for excellence has, since 1986, been expanding its network and gradually replacing analogue facilities with digital switching and transmission systems which are considered state-of-the-art technology. By the end of 1993 the capacity of the switching network was about 65% digital, while the digital transmission network constituted about 90% of the total.

The density of telephone lines for every 100 inhabitants currently stands at about 52, which compares favorably with European countries advanced in telecommunications, while the figure of 65 is targeted for 1997.

Today, Cyprus is primarily connected with the rest of the world via six satellite earth stations and three analogue submarine cables which form a highly reliable and flexible network.

One of the authority's main aims is to establish Cyprus as a center of telecommunications in the Eastern Mediterranean region to support the government's objective of turning Cyprus into an ideal services center and information hub. With this in mind, the Cyprus Telecommunications Authority has entered into agreements with Greece, Israel, Syria and Lebanon for the establishment of fiber optic submarine cable systems connecting these countries with Cyprus and through it with the rest of the world.

The Cyprus-Israel cable (CIOS) has already been installed and will be ready for service early this year. The tender for the construction of the Cyprus-Syria link (UGARIT) was recently awarded and the cable is expected to be ready for service by November this year.

Tenders have also been invited for the Cyprus-Lebanon cable (CADMOS) which is expected to become operational in March 1995.

The contract for a fourth fiber-optic submarine cable connecting Cyprus with Greece (APHRODITE 2) was awarded early in 1993. This cable is expected to be ready for service by September this year. Another cable, an extension of the Cyprus-Greece cable, will be laid between Greece and France—CYTA will be a major co-owner in this system.

A fifth fiber-optic cable connecting Cyprus with Egypt constitutes part of the SEA-ME-WE 2 submarine, fiber-optic cable, an extensive system stretching from Singapore across the Indian Ocean to the Mediterranean Sea and ending at Marseilles.

When completed in July this year, SEA-ME-WE 2, covering more than 18,000 kilometers, will be the longest fiber-optic, submarine cable laid to date. Cyprus Telecommunications Authority is participating in the construction of the cable system as a co-owner, with 53 other parties.

In line with the policy of establishing Cyprus as an information hub in the eastern Mediterranean region, the authority entered into an agreement with Russian organisations providing for the establishment of a satellite link between the two countries.

The agreement also provides for the routing of telecommunications traffic originating from Russia, as well as from other countries of the Commonwealth of Independent States, through Cyprus to the rest of the world and vice versa. The link will be used for telephony, data transmission, telefax, videoconferencing, etc.

At the same time, CYTA is proceeding speedily with the introduction of new services, using state-of-the-art technology, so as to meet market demand.

Among these services are the Pan-European Paging System ERMES, expected to operate in 1994; the Pan-European Cellular Mobile Telephone System (GSM) and an integrated Services Digital Network (ISDN) to be introduced in 1995, as well as a number of value-added services such as videotex, electronic mail, message handling system X.400 and voicemail in the 1994-1995 timeframe.

It is evident that the advanced, reliable and efficient telecommunications services offered by the Cyprus Telecommunications Authority, as well as its ambitious plans for the future, place Cyprus among the world's developed countries in this field and render it an ideal business center in the Eastern Mediterranean and Middle East region.

This is a U.S. Government publication. Its contents in no way represent the policies, views, or attitudes of the U.S. Government. Users of this publication may cite FBIS or JPRS provided they do so in a manner clearly identifying them as the secondary source.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. It should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed. Except for excluding certain diacritics, FBIS renders personal names and place-names in accordance with the romanization systems approved for U.S. Government publications by the U.S. Board of Geographic Names.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Central Eurasia, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be

provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735, or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.

END OF

FICHE

DATE FILMED

22 July 1994